SCIENTIFIC AMERICAN

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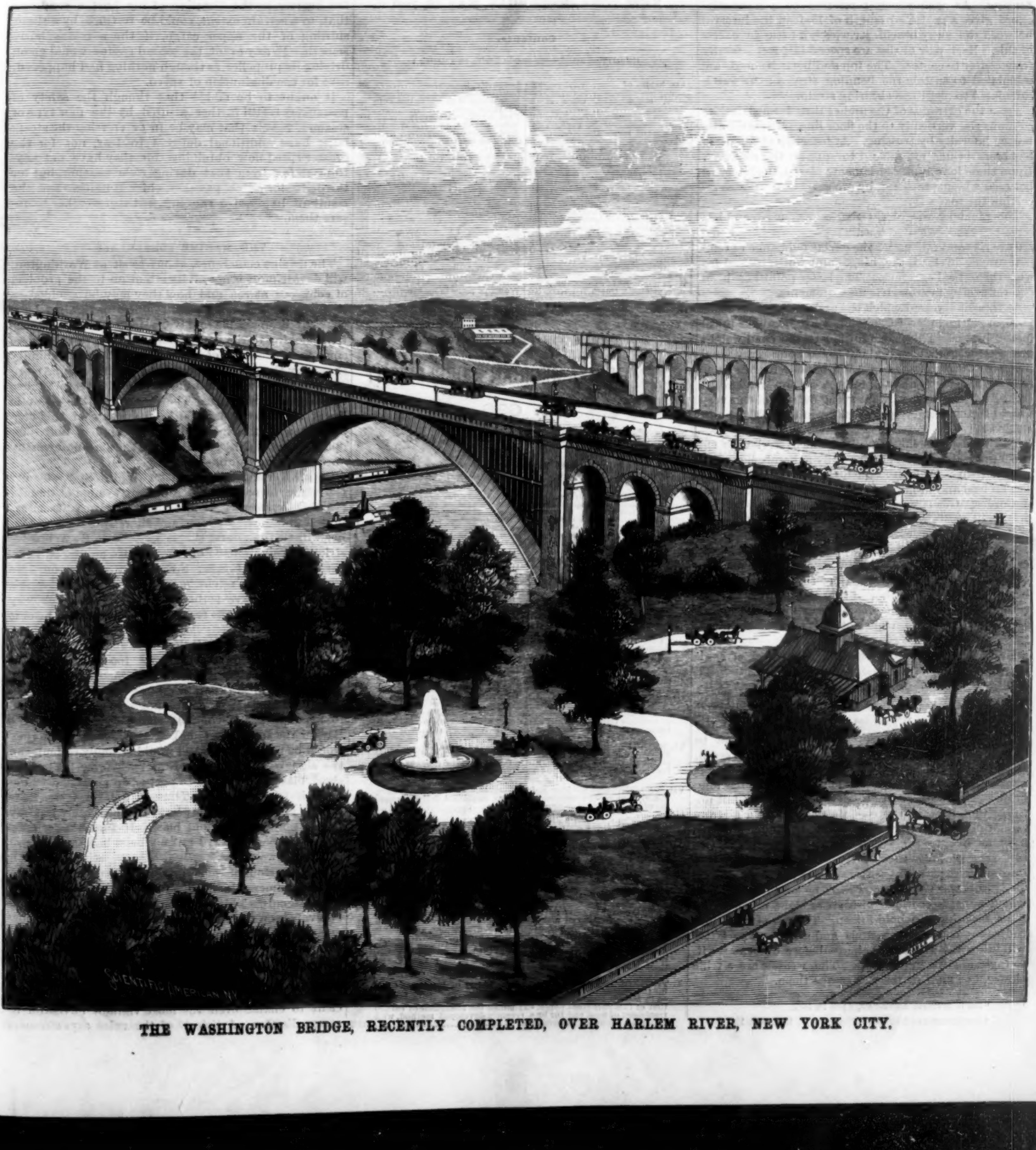
THE WASHINGTON BRIDGE, NEW YORK CITY.

In 1885, three commissioners, Messrs. Jacob Lorillard, David James King, and Vernon H. Brown, were appointed by the Mayor, Comptroller, and President of the Board of Aldermen of New York to be placed in charge of the erection of a new bridge for foot and carriage travel over the Harlem River at 181st Street. This was in accordance with an act passed by the State Legislature authorizing and directing the construction of such a bridge. On October 15 of the same year the commissioners advertised for competitive designs. In order to secure a number of meritorious plans, the following premiums were offered: $1,500 for the best design; $1,000 for the next in merit; and $500 for the third best. It was directed that the designs should be accompanied by specifications and approximate estimates of cost, and they were to be submitted before December 1. Restrictions were imposed upon the designs; a clear river space of 400 feet between the piers or bulkheads was to be provided for, and the grade of the roadway was to be 145 feet above mean high water. A steel or iron superstructure resting on masonry piers was specified as the type to be adopted.

The designs to which the first and second prizes were awarded were submitted by Mr. C. C. Schneider and Mr. Wilhelm Hilderbrand respectively. On comparing these designs with the bridge which has now been completed, it will be seen that the plans were followed quite closely as regards general features. Both were given in the SCIENTIFIC AMERICAN of March 6, 1886.

About the time of the centennial of the inauguration of Washington as President of this country, the bridge was thrown open without formality. Partly from the anniversary upon which it was completed and opened, and partly from its contiguity to Washington Heights and Fort Washington, the bridge was named the Washington Bridge. In our illustration we show the completed structure as it appears from the elevated ground on the western bank of the Harlem River, near 182d Street. Its general plan was the outcome of the conditions of the ground. An excellent place for one pier was determined by the presence of a bed of rock. The necessity of spanning of the river on one side and of the low ground on the other side dictated the two arch construction. The plan, as a whole, cannot well be attributed to any one man, but may be considered an outgrowth of many consultations of the engineers associated in its construction.

The foundation for the central pier rests upon a caisson, 104×54 feet, with roof 6 feet and sides 3 feet thick. Fifteen feet below the surface of the water rock was reached, its surface sloping toward the river. The caisson was with much difficulty carried downward, the rock being removed by blasting, until a depth of about 45 feet below high water was reached. Incandescent electric lights were used to light the interior



THE WASHINGTON BRIDGE, RECENTLY COMPLETED, OVER HARLEM RIVER, NEW YORK CITY.

during the progress of operations. Finally it was filled with concrete made with Portland cement mortar, 1 cement to 2 sand. A full description of this portion of the work has already appeared in these columns.* The other foundations presented comparatively little difficulty in execution.

The masonry superstructure is of granite, and includes an east and west approach terminating in abutments from which the two great arches spring. The arches meet again at a central pier which acts as abutment for both and which rises between them to the top of the bridge. The total length of the bridge and approaches is 2,380 feet; each approach is 660 feet long, leaving 1,060 feet for the main bridge. The western approach is level; the first portion, 260 feet in length, is in earthwork supported by masonry side walls. The rest is in masonry, including three semicircular arches, each of 60 feet span. The eastern approach starts on a lower grade, and for part of its length rises toward the bridge; 300 feet are in earthwork, as described for the other end. The remaining 360 feet includes three semicircular arches of 60 feet span and one seven-centered arch of 56 feet span. A clear width of 80 feet is afforded over this portion, as well as over the remainder of the structure, 50 feet of which are roadway, while 30 feet are devoted to the two sidewalks. The roadway is paved with asphalt.

The supporting members of the bridge proper consist of two steel arches of 510 feet span each and 90 feet versed sine. Each arch includes six parallel ribs 13 feet deep, divided by radial divisions so as to represent voussoirs. They are braced together horizontally to secure the whole against wind strains, and are connected by trusses at the junction of each voussoir lying in the plane of the radial divisions, so as to act as sway bracing. As each voussoir referred to a horizontal chord gives a projected length of 15 feet, the interval between the sway bracing trusses is a little in excess of this. Each pair of ribs are spaced 14½ feet laterally from center to center. The top and bottom chords are calculated to sustain the bending strains; the web is calculated to resist the shearing strain.

From the extrados of the arches thus formed, lattice columns rise vertically to the floor line. These are also braced laterally by trussing. At intervals of about 15 feet cross beams are placed to support the roadway. Upon these longitudinal beams are placed, the intervals between which are filled by arched buckle plates receiving the roadway.

The pivot system of skewbacks was used, and has already been illustrated in this paper.† As the arched trusses rise and fall under the effects of change of temperature or of load, the hinge joint works to and fro with theoretical exactness. The latter point has been determined by micrometric measurements.

As regards the load which the arches are constructed to carry, it includes 8,000 pounds live load per lineal foot of bridge. This is in addition to the dead weight of the structure, which is about 33,000 pounds per lineal foot. A wind pressure of 1,200 pounds for the same unitary distance is allowed for. A 20 ton road roller can be taken over it without going outside of the very liberal factor of safety provided for in the table of unit strains.

The roadway is 151 feet above the river level. On the approaches it is bordered by a handsome stone parapet, with bronze ornaments. The bridge proper has an iron and bronze rail, designed by Messrs. Delinas & Cordes. Gas lamp posts and combined gas and electric light posts are placed on either side. Over the piers stone refuges with seats are placed.

The bridge, as now situated, can be reached by the cable cars on Tenth Avenue, but the general condition of the roads leading to it on either side leaves much to be desired. It is to be hoped that the beautiful structure will soon be made more accessible, and that its absolute usefulness will not be postponed much longer.

Mr. William Hutton, of this city, was the chief engineer, assisted by Mr. Theodore Cooper.

An Irresistible Bait for Rats.

According to a Washington correspondent to the Cincinnati *Commercial Gazette*, an interesting not to say valuable discovery has been made by Capt. Weedin, in charge of the animals at the Zoo. The building is infested by rats, and how to get rid of them has long been a perplexing question. Traps were used, but nothing would tempt the rodents to enter. In a storeroom drawer was placed a quantity of sunflower seeds, used as food for some of the birds. Into this drawer the rats gnawed their way, a fact which led the Captain to experiment with them for bait in the traps. The result was that the rats can't be kept out. A trap which appears crowded with six or eight rats is found some mornings to hold fifteen. They are turned into the cages containing weasels and minks. The latter will kill a rat absolutely almost before one can see it, so rapid are its movements. The weasels are a trifle slower, but none of the rats escape them.

* See SCIENTIFIC AMERICAN, April 16, 1887.

† See SCIENTIFIC AMERICAN, February 18, 1888, page 101.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 698.

For the Week Ending May 18, 1889.

Price 10 cents. For sale by all newsdealers.

A REMARKABLE OCEAN VOYAGE.

Five days twenty-three hours seven minutes is now the top record across the Atlantic, the City of Paris making it on her last trip this way—a remarkable trip, not only because it beats by two hours forty-eight minutes the best previous record, to wit, that made by the Etruria last June, but because she is a new ship, and, at least for a small portion of the voyage—crossing the Banks—was slowed down. Thus it is not unreasonable to expect still more of this ship, when her engines shall have become more smooth by attrition and her commander more familiar with her characteristics.

To many the mere fact of record beating will not compare in importance with the fact of using double engines and twin screws on so big a ship. With these and the re-arrangement of bulkheads which they permit, the safety of a ship is believed to be increased. Heretofore a steamer parting her shaft lay helpless on the broad ocean, her sole reliance the coming of another ship to her rescue.

There is another and perhaps it might be called a still more important factor of safety in the twin engine arrangement—it permits the subdivision of that longitudinal section of compartment which heretofore has made the most modern ship vulnerable abaft the mainmast. This contained the engines and the boilers, and the gross weight of sea water it would contain was sufficient to more than counterbalance the ship's buoyancy. With the sister ships City of New York and City of Paris, this compartment is divided into two parts, a separate engine and boilers being placed in each. Should one of these be torn open by collision and flooded, it would not swamp the ship or even destroy her power of locomotion. She would heel over a few degrees in the direction of her hurt, a condition that, to a certain extent, could be rectified by a slight shifting of the upper cargo, if the sea was fairly smooth. In any event, the second engine would go on driving its propeller as though nothing had happened, save for the diminution of speed.

It ought to be added that though the safety of passengers is still further assured by the new type of steamer, vessels that may be in or crossing the steam lanes have additional dangers to fear, not for the greater speed now obtaining, for they have not anything to fear from that during clear weather, but for the desire for quick passages which it induces and the resultant haphazard running in thick weather to insure them.

THE MARINE CONFERENCE.

The marine conference, about to sit at Washington, will devote most if not all its attention to the problem of collisions at sea and how they may be avoided—a problem, be it said, which the ablest navigators have thus far been unable to solve. Many practical suggestions looking to the improvement of the sea rules have come from this side of the water, and the unanimity shown by the maritime powers in joining in an American conference is a not undeserved tribute to Yankee cunning and resource. The masters of the Atlantic liners are most concerned in the result of this conference, and it is interesting, therefore, to note their opinions on the subject. Here are the most noteworthy ones as recently published:

Capt. Kennedy, late master White Star steamer Germanic, favors Barker's American system of signals. [In this, a steamer running in thick weather is expected to indicate by long and short sounds blown on her whistle the course she is holding.] He would restrict the signals to 8; one for each 4 points, N. to N. E.; N.E. to E.; E.S.E.; S.E. to S., and so on. He would, however, advise a separate signal for vessels bound east or west; the first signifying which way the ship is bound, the second the direction her head is pointing.

Capt. Brooks, of the Guion Line's steamer Arizona: "All the codes I have yet seen are too complicated for practical use. Two steamers approaching each other at the rate of 40 knots an hour—combined speed—would not allow their commanders to act if they had to make any such compass signals [referring to the Barker and similar systems]. Nine times out of ten they would be misunderstood. I would strongly recommend the signals in use by the New York ferry boats: one short blast, my helm is to port; two short blasts, my helm is to starboard. Thus, if I hear a steamer's whistle ahead on my port bow, I immediately put my helm a-port and blow one blast. If I hear the whistle on my starboard bow, I put my helm hard a-starboard and blow two blasts."

Capt. Burton, of the White Star steamer Coptic: "I think steamers should be fitted with two separate steam signals. This could be accomplished by having two valves on the same steam pipe." He would blow one whistle for from N. to E., another for from E. to S., etc.—four signals in all.

Capt. Boyer, of the French line's steamer La Champagne: "The rules laid down by the International Convention [the last one] are absolutely insufficient to enable even the most vigilant navigator to escape disaster. Article 12 of the rules says steamers

must have steam whistles with the sound unbroken by any obstacle. As it is the waves of sound are broken by the masts [in front of them]. The proper place for a steam whistle is in the bow. Two fast vessels approach one another at 40 knots an hour or $\frac{66}{100}$ knot per minute. To avoid collision here, the warning sound should be heard six minutes before the ships meet. Hence it is necessary that the whistle should carry the sound $\frac{66}{100} \times 6$ or $\frac{396}{100}$ of a knot, equal to about four nautical miles. Article 12 also says that steamers [running in thick weather] 'shall give a prolonged blast of the whistle at intervals not exceeding two minutes.' This is not often enough. There ought to be one minute intervals. Again: 'Every steamer shall go at reduced speed in thick weather.' The phrase is vague. It is to be hoped that science may discover some means of more precisely locating a sound at sea, as now it often appears to come from a direction opposite to that whence it actually proceeds." Until a practical system can be hit upon, he thinks steamers should be made to take routes according to the season.

What Captain Boyer says about the uncertainty of sound, especially if the wind is abeam, or quartering, has often been remarked. Every sailor has witnessed the phenomenon of a fog signal coming from two or more quarters, as if a stranger was advancing from several points at the same time. Perhaps the adoption of Captain Boyer's suggestion of a whistle on the bow would obviate this uncertainty or some of it; the sound having then no masts ahead to deflect it. Even then there is reason to believe that such signaling of courses would be of little avail, for of what advantage is it for a master to know a stranger is approaching, say from the E.S.E., if he is ignorant, and of course he must be, of the known point from which that course is laid off? A ship can be coming straight for his bow, a second for his broadside, a third for his quarter, and all be heading E.S.E. and sailing on parallel lines, the one to the other. Captain Brooks' commendation of the rule followed by the New York ferry boats would seem to be fully deserved. Indeed, this system will scarcely fail to find more or less favor with practical navigators, though with such speed as that prevailing among the ocean greyhounds, still more certainty than this will assure is desirable and, indeed, necessary. In the ferry boat service, such as that obtaining hereabout, the conditions which on the broad seas are fraught with such imminent dangers are often present. A fog signal ahead means as little to the pilot of a ferryboat as to the master of an ocean steamer. He knows something is coming his way, but not just where it may be expected to appear. But if the pilot of that something has a means of assuring him that he has ported his helm, he has something definite to steer by, and porting his own helm, he veers off in a contrary direction till the lessening sound of the stranger's whistle assures him that danger is past and that he may safely bear up again on his course. Most of the steamship collisions have been caused by ships turning the same way at the vital moment. The officer of the deck hears a steamer dead ahead, and, with nothing to guide him, orders the wheel put hard down. The strange sail, thinking to weather him, puts his helm up, and they meet.

There is much hard practical sense in this rule of the New York ferry boat pilots, and doubtless there is a hint in it that the coming marine conference may study with profit.

Transmission of Power through a Bore Hole.

Mr. Wm. Hall, manager of the Spring Hill (N. S.) mines, gives the following account of the successful completion of a winding plant, situated on the surface, and hoisting from an underground slope. A bore hole 4 inches in diameter has been put down from the surface to the bottom of 1,300 foot level (north slope), a depth of 600 feet perpendicular. An engine and boiler have been placed in position on the surface close to the bore hole. Power is then transmitted by means of a wire rope and an arrangement of pulleys at the top and bottom of the bore hole. Beside the wire rope in the bore hole is placed a signal cord. By means of this cord communication is kept up between the engine men and the man at the bottom. The first cost of the bore hole is not nearly so great as that of 1,800 feet of steam pipes, while the cost of repairs, where pipes are suspended from the roof by means of hooks, will be entirely saved. Other repairs necessary to prevent leakages in the pipe will also be obviated, thus effecting a very material annual saving.

The Electrical Omnibus in London.

The electrical omnibus lately left the depot of the Ward Electrical Car Company, and ran to Euston Station. Some of the directors and the manager of the Liverpool Tramways Company were awaiting it, with Sir George Baden-Powell, M.P., and Mr. Houlding, the chairman of the sanitary committee of the Liverpool corporation. The omnibus returned by way of Euston Road, Great Portland Street, and Regent Street, to the company's depot at James Street, Haymarket. It came through the crowded traffic without exciting any alarm on the part of even private carriage horses.

Department of Microscopy, Brooklyn Institute.

The annual reception of the Department of Microscopy of the Brooklyn Institute occurred on Thursday, May 9. There were in position more than 50 microscopes, each arranged to exhibit an object of interest. These microscopes were placed on six long tables, each table provided with three incandescent lamps supplied with a current from Mr. E. R. Knowles' patent storage batteries, furnished for the occasion by the Mutual Electric Manufacturing Co., of Brooklyn. The lamps were maintained during the entire evening at a high state of incandescence, giving a very white light, well adapted for the display of microscopic objects, particularly those requiring the polariscope. The yellow hue so familiar to those in the habit of using kerosene lamps was entirely wanting. Besides this advantage, there was an absence of heat; the lady visitors could view the objects without fear of burning their hats, a common occurrence when lamps are used. A rare opportunity was afforded to several hundred interested spectators to see in an hour more of the minute wonders of nature and art than they would be liable to see in a lifetime but for such an occasion as this.

The following is a list of the objects exhibited, together with notes briefly describing the objects:

Rev. J. L. Zabriskie, the president of the section, exhibited two very interesting objects, the peridium of the fungus (*Ræstelia aurantiaca*) from the immature fruit of the English hawthorn, and the ovipositor of the pigeon borer, the latter being shown by polarized light. This is a hymenopterous insect, whose larva burrows in the languishing wood of various trees, such as maple, elm, and hickory.

Mr. George M. Mather, vice-president of the section, exhibited the elytron of diamond beetle, showing the gem-like scales, which present all of the colors of the spectrum in great brilliancy. The same exhibitor showed natural crystals of malachite and azurite. These are ores of copper which are found associated in Arizona copper mines.

Fossil seeds of chara, of the Eocene period, found in the Isle of Wight, were exhibited by Mr. George E. Ashby, the secretary of the department. The seeds of this water plant are found ranging through the strata of the whole tertiary period.

Mr. E. C. Chapman, the treasurer of the department, exhibited a beautiful mount of platino-cyanide of yttrium by polarized light. Mr. Chapman says that Professors Young and Lockyer think that yttrium exists in the sun.

Mr. A. A. Hopkins, the curator of the department, exhibited a beetle's eye, through which the spectator was able to see hundreds of images of a moving object placed in the field of view.

Mr. William Potts, treasurer of the Institute, exhibited specimens of volvox. This beautiful aquatic plant is of spherical form and maintains a continuous rotation by means of cilia.

Mr. Geo. B. Scott had an interesting exhibit of moth eggs, some of which were just hatched, and the young caterpillars were seen standing on the eggs. Crystals of metallic chromium were exhibited by Mr. F. L. Lathrop. These crystals were obtained by Prof. A. K. Eaton. It is believed that this is the first time that this object has been exhibited under the microscope. Mr. Frederick Braun exhibited *Eozoon Canadense*, a fossil found in the rocks of the Laurentian age.

Salicine was exhibited by Mr. H. Fincke under the polariscope. This is an alkaloid obtained from the bark of the willow tree. It is noted for its brilliant display of color when exhibited by polarized light. The same exhibitor showed brilliant octahedral crystals of arsenious acid; also portulacca seed; the proboscis of a horse fly, showing the lancets; and a slide of diatoms containing 57 specimens beautifully arranged within the space of five one-hundredths of a square inch.

Mr. Joseph Ketchum projected a thin section of the intestine of a cat, stained and injected. He also exhibited a beautifully arranged slide of foraminifera. These minute fossil skeleton remains are found in many geological periods, and vast deposits of rocks are made up entirely of these minute shells.

Mr. Frank Healy exhibited a leaf of *Pomaderris apetala*, showing beautiful stellate hairs. Human blood disks, stained so as to show the red and white corpuscles, were shown by Frederick J. Wuling, Ph.G. Dr. S. E. Stiles exhibited the eggs of the stone mite.

Mr. G. M. Hopkins showed crystals of salicine under polarized light. Half of the field was backed by mica, so that the radial color bands in the crystals on opposite sides of the median line of the mount revolved in opposite directions, showing the curious effect of thin films on polarized light. Dr. Alexander Hutchins showed a section of the human stomach. Dr. J. H. Hunt showed beautiful specimens of ruin agate by the aid of polarized light.

A specimen of mica from Sing Sing, N. Y., containing aciculate crystals of rutile deposited between the lines of growth of the crystals, was shown by Mr. Geo. F. Kunz. These crystals, when viewed by transmitted light, produce the appearance of stars.

Mr. T. B. Briggs exhibited a specimen of anthophyllite of his own preparation. This beautiful specimen was chipped from a Brooklyn bowlder.

Mr. Edgar J. Wright exhibited living hydra having six to ten tentacles. The contortions of this animal in search of its food are at least suggestive of the devil-fish.

Dr. A. J. Watts showed moss-like and fern-like gold crystals of his own preparation. These beautiful forms were crystallized under the influence of electricity.

A section of rock from summit of Mount Sinai was shown by Mr. James Walker, and *Spirogyra nitida*, in conjugation, were exhibited by Mr. J. W. Martens, Jr.

Mr. J. W. Freckelton exhibited (by reflected light) a fragment of fire opal from Honduras. A longitudinal section of human skin, showing hair follicles, was shown by Dr. Z. T. Emery. Dr. E. W. Owens exhibited the head of a spider, showing eight eyes, also a mount of arranged diatoms containing 289 forms.

The smallest exhibit of mechanical work was exhibited by Dr. F. D. Bailey. It consisted of the Lord's prayer engraved on glass within the space of 1-1200 of a square inch. Mr. J. D. Mallonee exhibited the eyes of a butterfly. Prof. W. Le Conte Stevens, of the Packer Institute, Brooklyn, exhibited a fine specimen of native copper crystals.

Mr. H. S. Woodman exhibited diatoms from the Pacific coast, which were cleaned and mounted to show by reflected light. The most noticeable forms are *Arachnoidiscus Ehrenbergii* and *Triceratium Arcticum*.

Crystals of ammonium oxalate were shown by reflected light by Mr. H. B. Baldwin; and Mr. C. W. Boyer exhibited a cross section of the stem of a dandelion. Fossil insects in amber were shown by Mr. W. G. Bowdoin. Over 1,000 species have been identified in this gum, nearly all of which are now extinct. Mr. Stephen Helm had an interesting exhibit of pond life. H. Hensoldt, Ph.D., showed a section of oolitic limestone containing fluid cavities.

The circulation of blood in a frog's foot was shown by Dr. C. N. Hoagland. The blood corpuscles moving in rapid streams through the minute channels was a very curious sight.

Trichinæ in a cat's tongue was shown by Dr. D. Rollins Brown. Crystals of butter were exhibited by polarized light by Mr. John Loeber. Mr. William Finney showed a cross section of whalebone, exhibiting a curious cellular structure.

House-top Summer Resorts.

A plan to make our house-tops useful is sketched by Dr. Gouverneur M. Smith, in a paper on "Wasted Sunbeams—Unused House-tops." The Oriental has no difficulty in the matter. He lives on the top of his house a considerable part of the year, and builds his roof with an especial eye to that sort of occupation. Why may not we? By pitching our tents upon them, or by taking them as they are, except that the roof coverings would have to be made more solid, we might make our roofs comfortable sojourning places and inexpensive summer health resorts.

"Roofing," says the author, "can be contrived suited to this climate, and enduring as pavement. A pleasure resort might ornament each residence, its limits bounded by the area of the dwelling; neighborly consent could widen the range, turf and flowers brighten the plan. Iron-framed and glass-inclosed rooms or cupolas could be added, which would prove useful during all seasons, artificial heat tempering brumal inclemency. If such adaptation of house-tops would be an advantage to the affluent, who can escape city life during the summer, how much greater advantage would be secured to the tenement house districts! . . . For the higher graded tenement houses, such fresh air facilities would be hailed with delight by the inmates. The proximity of open breathing places to their rooms would endear their humble homes. Summer moonlight evenings could have a new aspect; and again, round a family lantern, groups might gather to read, sew, or engage in games, and thus a home-felt pleasure could quiet restless spirits, craving questionable or illicit amusements. More true enjoyment might be observed in such groups than on the piazzas of fashionable resorts. Landlords could arrange for the periodical sweeping of roofs, as well as of the halls and stairways, and, among a very large class of the respectable poor, pride would stimulate to a tidy and decorative care of their home parks."

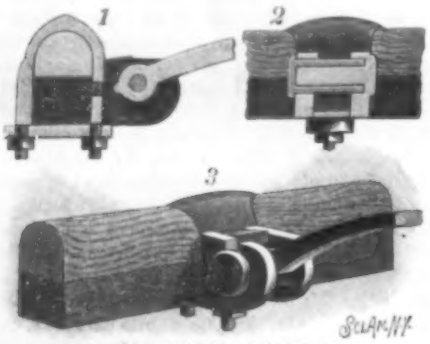
By a little alteration in structure the upper stories of houses, now stuffy places enough, could be made light and airy, and attractive as resorts or play rooms in inclement weather.—*The Popular Science Monthly.*

Arsenic in Bone Meal.

"Feeding bone meal," so-called "precipitated phosphate," has been successfully added to the food of cattle in doses ranging from 2 to 15 grms. daily for young animals and 20 to 50 grms. for adult individuals. If the acid used in the manufacture is arseniferous, calcium arseniate or arsenite will accompany the phosphate. The proportion of arsenic in the samples examined ranged from 0·028 to 0·17 per cent (calculated as metallic arsenic).—*H. Fresenius.*

AN IMPROVED THILL COUPLING.

An invention providing for the ready adjustment of the thill eye or head to the socket of the axle clip, and for the holding of the thill head in yielding contact with its supporting attachment, is illustrated herewith, and has been patented by Mr. Frank Gandy, of Freeport, Ohio. Figs. 1 and 2 are sectional views, and Fig.

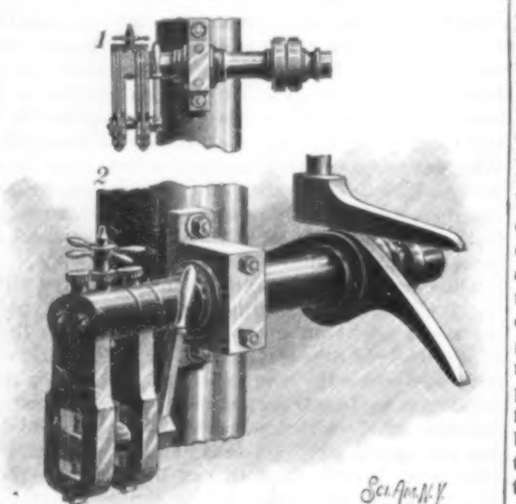


GANDY'S THILL COUPLING.

3 represents the device in perspective. The clip is made with two forwardly extending arms, one arm having a laterally extending stud and an annular recess, while the other arm has an aperture through its upper edge and a side recess, there being a rubber block supported by a pin between the arms. The body of the clip is recessed just to the rear of the rubber block, and in the recess is arranged a spiral spring bearing against the axle and normally forcing the rubber block forward, holding it against the thill head, and thus preventing all rattling. The thill iron can only be removed from the clip by elevating the thills and bringing the irons in register with the opening in the top of one of the clip arms.

AN IMPROVED CUT-OFF VALVE GEAR.

The cut-off valve represented herewith is specially adapted for marine engines, having a variable cut-off designed to work steam expansively at all points from the dead center to the full stroke, and being an improvement upon what is known as the "Stevens" cut-off. It has been patented by Mr. Andrew L. Harrison, Chief Engineer U. S. Revenue Cutter Colfax, Wilmington, N. C. The invention provides a me-



HARRISON'S CUT-OFF VALVE GEAR.

chanical device adapted for attachment to the end of the rock shaft, whereby the adjusting of the lead of the steam valves, and taking off the lead and putting it on, may be accomplished at will with the engine in motion, the engine not having to be stopped to roll the eccentric on the main shaft, as according to the present practice. As the slots in the arms are not cut on a radius from the center of the main shaft, when the pin is moved up or down in them the lead of the valves is changed, also their lift or throw, and the steam may be cut off shorter or longer to change the speed of the engine slow or fast, as desired, leaving the throttle valve wide open at all times, and at the same time permitting the steam to be worked expansively at all times.

Compressed Gas as a Cautery.

Dr. Benjamin W. Richardson, ever foremost in practical scientific medicine, has made a suggestion in the last number of his quarterly periodical, the *Asclepiad*, which is as interesting as it is novel. It is to use a jet of highly compressed gas as a cautery. It is known that accidents occur to workmen sometimes in factories where compressed gases are prepared or employed from such a jet impinging on any part of the body, and causing an injury of the same nature as a burn. Dr. Richardson turns this property to account, and suggests its employment for the removal of warts or small pendulous growths. It does not appear that he has carried out the idea in practice, but there is little doubt we shall shortly hear of his doing so. He points out its advantages over the cautery, heated wire, or knife, in that it is less alarming and for the moment painless, as cold is an anæsthetic. He enumerates the gases which might be used, and specifies chlorine as no doubt most effective. He, however, gives the palm to carbonic anhydride (CO_2), as most manageable, cheap, almost inodorous, not unwholesome, and not inflammable, so that it can be used with artificial light. It is now a little over twenty years since Dr. Richardson introduced ether spray as a means of producing local anæsthesia. It remains to be seen whether the present suggestion may not lead to an equally important weapon in the armory of the surgeon.

Mr. Stanley on Arrow Poison.

Mr. H. M. Stanley, the African explorer, in a letter which was read at a recent meeting of the Royal Geographical Society, gave an extremely interesting reference to the arrow poison employed by the natives of the Lower Congo district, and it afforded a curious insight into the strange perversions of knowledge by which the advances of civilization are retarded. Mr. Stanley says they were much exercised as to what might be the poison on the heads of the arrows by which Lieut. Stairs and several others were wounded, and from the effects of which four persons died almost directly. The mystery was solved by finding at Arisibba several packets of dried red ants. The bodies of these insects were dried, ground into powder, cooked in palm oil, and smeared on the points of arrows. It is well known that formic acid exists in the free state in red ants, as well as in stinging nettles, and in several species of caterpillars. This acid is, in the pure state, so corrosive that it produces blisters on the skin, and hence there is little ground for doubting that it was the "deadly irritant' by which so many men have been lost with such terrible suffering." The multitude of curious insects encountered, which rendered their lives "as miserable as they could well be," bears out Mr. Stanley's idea that many similar poisons could be prepared from insects.

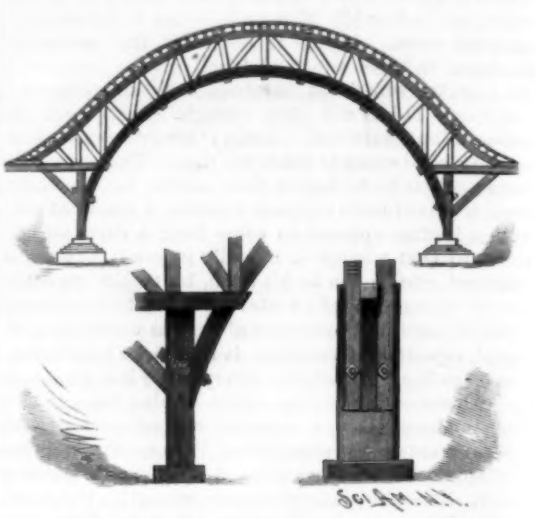
AN IMPROVED RADIAL TUBE BOILER.

The boiler shown in the accompanying illustration is designed to make more steam and drier steam than has heretofore been possible in boilers of this class, while the tubes are not liable to become obstructed with mud and scale. It has been patented by Messrs. John Clarke and Robert W. Savage, of Tyler, Texas. The boiler is constructed with a horizontal steam reservoir at its top, supported by standards firmly secured to the foundation, while suspended from this steam reservoir above the fire box is a vertical steam-generating chamber, with radial tubes extending therefrom. A fire brick casing surrounds the fire box and the radial tube steam-generating cylinder, while a fire brick arch partly surrounds the horizontal steam cylinder, a metal covering surrounding the fire brick, and extending above it to the smoke pipe or flue. Fig. 2 is a sectional view of the steam reservoir, showing tie rods which extend to the lower end of the vertical chamber. As deposits from water used in boilers are generally found at the points where there is least commotion, it is the design of this invention that such place shall be in the ends of the horizontal reservoir, from which the deposits may be readily removed by blow-off cocks on the man hole. The inventors claim that, in practical work, they have demonstrated that their boiler can thus be readily operated without deposits of scale, etc., being made in the tubes.

CLARKE & SAVAGE'S RADIAL TUBE BOILER.

IMPROVED TRUSS FOR BUILDINGS OR BRIDGES.

A truss combining simplicity with great strength, and at the same time dispensing with metallic braces, forms the subject of a patent issued to Mr. John T. Wells, of Scottsville, N. Y., and is illustrated herewith, the small figures showing a section and an end elevation. The invention consists of two parallel arches,



WELLS' TRUSS FOR BUILDINGS OR BRIDGES.

formed of bent boards and connected with each other by posts and braces. The side posts which rest upon the piers are stepped on their inner sides to fit the lower ends of the inner arch, the ends of the arch being secured in place by bolts, and the second arch is connected with the inner one by posts placed radially between them, and fastened by spikes or other means. Suitable braces are placed between the posts and the arches, the last posts not extending to the inner arch, but resting on top of horizontal beams, each of which is supported near its outer end by a brace. Each truss thus constructed is designed to form one section of a building or a bridge, which may thus be made very strong without using metallic rods or braces.

IMPROVED KNIFE FOR PRINTERS' USE.

A knife especially designed for the use of pressmen in cutting out "overlays" or "underlays" in making a

DUS' KNIFE FOR PRINTERS' USE.

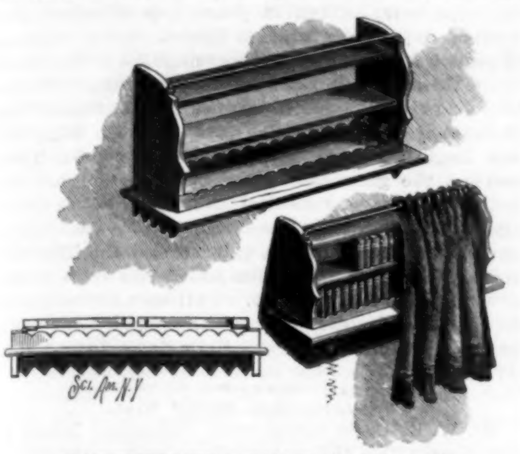
form ready is shown in the accompanying illustration. The handle is a piece of tubing with longitudinal slots for sliding studs, by means of which the blades in either end are moved in or out. One of the blades is sharpened on its opposite edges in form much to resemble an ordinary ink eraser, while the other blade holder has pivoted therein a blade sharpened on three sides and edges, whereby the blade may be turned and adjusted to cut at any desired point and from any of its edges. This blade is retained in position when adjusted by a spring pawl made to engage with a ratchet fast on the blade or its pivot. The rotatable blade is designed to do the general work of the pressman in making forms ready, while the other blade may be used exclusively for cutting sharp angles or corners. Movable caps are provided for covering the ends of the knife, so that it may be carried in the pocket, these caps having spring catches for engagement with the slotted portions of the handle.

For further information relative to this invention address the patentee, Mr. Louis J. Dus, No. 819 Eighth Street, Milwaukee, Wis.

A PHOTOGRAPHIC exhibition is now in progress at the Crystal Palace, London, in which, according to the London papers, a preponderance of the actual or comparative novelties consists of American inventions on sale by English firms.

AN IMPROVED FOLDING BOOK CASE.

A folding book case designed to have a certain amount of rigidity is illustrated herewith, and has been patented by Mr. Phillip Kaffenberger, of Springfield, Mo., the small figure being a front view showing the hinged parts in their folded position, without the removable shelves. The case is made with a permanent



KAFFENBERGER'S FOLDING BOOK CASE.

board or bottom shelf, to which short side pieces are permanently attached, and folding side parts hinged thereto, grooved to receive the shelves. The bottom board has strips supported thereon or pendent therefrom, which may serve as ornaments or as receptacles for the removable parts during transportation or storage. A tie rod is used to connect the ends of the side parts at the top, this rod also serving as a curtain rod.

MAKING CARBON RODS AND PLATES.

BY GEO. M. HOPKINS.

Carbon rods and plates of the finest quality can be made economically only by the use of expensive machinery and apparatus, such as pulverizing mills, hydraulic presses, and retorts or ovens ; but the amateur, without a great deal of trouble, and with very little expense, can make carbon plates and rods which will answer a good purpose. The materials required are coke, wheat flour, molasses or sirup, and water. The tools consist of a few moulds, a trowel or its equivalent for forcing the carbon mixture into flat moulds, tubes to be used as moulds for carbon rods, and ramrods for condensing the material in the tubes and forcing it out, and an iron mortar or some other device for reducing the coke to powder.

Clean pieces of coke should be selected for this purpose, and such as contain no volatile matters are preferred. The coke is pulverized and passed through a fine sieve. It is then thoroughly mixed with from one-sixth to one-eighth its bulk of wheat flour, both being in a dry state. The mixture is moistened with water (or water with a small percentage of molasses added) sufficiently to render it thoroughly damp throughout, but not wet. It should now be allowed to stand for two or three hours in a closed vessel to prevent the evaporation of the water. At the end of this time the mixture may be pressed into moulds of any desired form, then removed from the moulds and dried, slowly at first, afterward rapidly, in an ordinary oven at a high temperature. When the plates or rods thus formed are thoroughly dried, they are packed in an iron box, or, if they are small, in a crucible, and completely surrounded by coke dust to exclude air and to prevent the combustion of the plates or rods during the carbonizing process. The box or crucible must be closed by a noncombustible cover and placed in a furnace or range fire in such a way as to cause it to be heated gradually to a red heat. After the box becomes heated to the required degree, it is maintained at that temperature for an hour or so, after which it is removed from the fire and allowed to cool before being opened. The rods or plates are then boiled for a half-hour in thin sirup or in molosses diluted with a little water. They are again baked in an ordinary oven and afterward carbonized in the manner already described. This latter process of boiling in sirup and recarbonizing is repeated until the required density is secured.

As some gases are given off during carbonization, it is necessary to leave the box or crucible unsealed to allow these gases to escape.

Fig. 1 shows an inexpensive form of mould for flat carbon plates. It consists of two right-angled pieces of wood of the thickness of the carbon plate to be made, and a thick plate of sheet iron. The iron should be oiled or smeared with grease before the mould is filled. The carbon and flour mixture is pressed into the mould smoothly, the wooden pieces are removed, and the carbon is left on the iron plate to dry. When dry, it is easily separated from the plate and may be handled without danger of breaking.

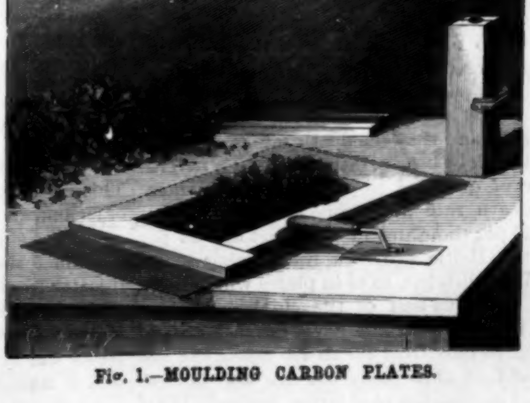


Fig. 1.—MOULDING CARBON PLATES.

Fig. 2.—MOULDING CARBON RODS.

Cylindrical carbon rods may be formed in a wooden mould, as shown in the background of Fig. 1, and dried in a grooved iron plate adapted to receive them, or a brass tube may be used as a mould, as shown in Figs. 2 and 3. To facilitate the filling of the tube, a funnel may be formed on or attached to one end. The tube may be filled with carbon entirely from the top, or it may be partly filled by forcing its lower end several times down into the carbon mixture, finishing the filling at the top. The lower end of the tube is placed on an iron plate and the contents are rammed from time to time during the filling operation. When the tube is filled, it is discharged in the manner illustrated by Fig. 3, *i. e.*, by pulling it over a fixed rod while its discharge end delivers the carbon cylinders to the iron plate on which they are to be dried and baked preparatory to carbonization. The plate in this case should be oiled to prevent the adhesion of the rods. The rod by which the contents of the tube are ejected should be on a level with the top of the iron plate. Fig. 4 shows in section an iron box containing plates and rods packed ready for carbonization.

Fig. 3.—DISCHARGING THE MOULD.

Fig. 4.—CARBONIZING BOX.

Substances Liable to Spontaneous Combustion.

Cotton-seed oil will take fire even when mixed with 25 per cent of petroleum oil, but 10 per cent of mineral oil mixed with 10 per cent of animal or vegetable oil will go far to prevent combustion.

Olive oil is combustible, and, mixed with rags, hay, or sawdust, will produce spontaneous combustion.

Coal dust, flour dust, starch, flour (especially rye flour) are all explosive when mixed with certain proportions of air.

New starch is highly explosive in its comminuted state, also sawdust in a very fine state, when confined in a close chute and water directed on it. Sawdust should never be used in oil shops or warehouses to collect drippings or leakages from casks.

Dry vegetable or animal oil inevitably takes fire when saturating cotton waste to 180° F. Spontaneous combustion occurs most quickly when the cotton is soaked with its own weight of oil. The addition of 40 per cent of mineral oil (density 0·890) of great viscosity, and emitting no inflammable vapors, even in contact with an ignited body, at any point below 338° F., is sufficient to prevent spontaneous combustion, and the addition of 20 per cent of the same mineral oil doubles time necessary to produce spontaneous combustion.

Patent driers from leakage into sawdust, etc., oily waste of any kind, or waste cloths of silk or cotton, saturated with oil, varnish, turpentine. Greasy rags from butter, and greasy ham bags. Bituminous coal in large heaps, refuse heaps of pit coal, hastened by wet, and especially when pyrites are present in the coal ; the larger the heaps, the more liable.

Lampblack, when slightly oily and damp, with linseed oil especially. Timber dried by steam pipes, or hot water or hot air heating apparatus, owing to fine iron dust being thrown off ; in close wood casings or boxings round the pipes, from the mere expansion and contraction of the pipes.—*American Miller.*

BAND CUTTER PLATFORM FOR THRASHING MACHINES.

The illustration herewith represents a simple construction of platform which may be conveniently and

LEEPER'S BAND CUTTER PLATFORM FOR THRASHING MACHINES.

expeditiously attached to the wheel of a thrashing machine, or the wagon carrying it, whereby the person cutting the bands of the grain may be provided with a firm and comfortable support. It is a patented invention of Mr. Alfred B. Leeper, of Owaneco, Ill. Upon the under side of the platform are two transverse brace bars, one of which has on its under face a semicircular recess adapted to conform to the contour of the wheel tire, and a clamp adapted to engage the wheel felly. To the other beam is hinged a brace bar, as shown in the sectional view, adapted to support the platform, its free end resting upon the hub of the wheel and bearing against one of the spokes, the bar having a recess to receive the spoke. This bar, when the platform is not in use, is folded up against its under side.

Beginning of Electrical Practice.

Mr. Deland has an article in the *Electric World* instructive to a large class of young persons who are seeking information as to the best means of learning the electrical trade.

He thinks that a young man who has evinced a taste for electricity can find no better opportunity of learning its practical applications than in the employ of a good electrical supply house, which carries in stock a large number of testing instruments and all the various apparatus which are in daily use in the different branches of electrical application. A training founded on a few years' experience in such a place must indeed be of considerable value to any one, no matter in what direction his later and cultivated energies may direct him, and we believe that not a few of our prominent electricians have at one time or another served an apprenticeship of this sort, which has be_n turned to good advantage later on.

A Cheap Telephone.

A correspondent in the *American Artisan*, who claims to have had considerable experience in that line, says a good working telephone may be made as follows : Make two tin drums six inches in diameter and four inches deep. They should have a heavy wire formed in same as half gal. cup. The wire should not be less that No. 9. Take rawhide that has been divested of hair and stretch it over the drum while wet, and bind it on with a small wire ; let it remain till perfectly dry. A very thin hide, such as squirrel, cat, coon, is the best. Thick hide will not work well. Now, to erect your drum, wire, etc., having set your posts and put up your insulators, which may be made of wire and suspended from arms which have been nailed to the posts, bore a hole in the wall where the drum is to be placed, run the wire through your drum and through the rawhide in the center, having a button ready. Pass the wire through the eye of the button and back through the drum and twist tightly, letting the button go, resting it on the hide. Put up the wire at the different insulators (string loop suspenders) till it reaches the other end of the line ; then proceed to do as at first. If the wire has been properly stretched and all the work has been done as it should have been done, you will have a good and cheap telephone. No. 18 copper wire for main line should be used.

The New Navy.

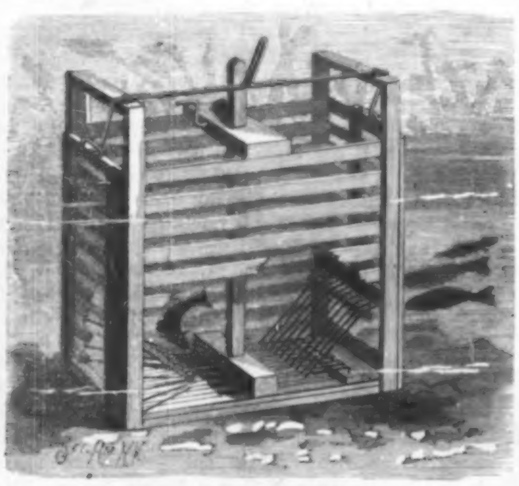
An interesting account of the new American navy is embodied in the annual report of the American Iron and Steel Association. All the vessels for the new navy, except five partly completed iron monitors, are or will be built of steel. After long delay the completion of these monitors has recently been authorized. Their keels were laid in 1874 and 1875. They are armored and double-turreted. Each monitor is to have four 10-inch breech-loading rifled guns in its main battery and several rapid-fire and Gatling guns in its secondary battery. The guns of the main batteries are all breech-loading rifles. Besides the main batteries, each vessel will be equipped with a secondary battery, which in nearly every ship will consist of several small rapid-fire guns, from 6-pounders down, revolving cannon, and from two to four Gatling guns. The vessels recently built or now building are:

Vessel.	Type.	Displacement. Tons.	Main Battery.
Texas	Belted	6,300	2 12-inch.
			6 6-inch.
Maine	Belted	6,648	4 10-inch.
			6 6-inch.
Chicago	Cruiser	4,500	4 8-inch.
			8 6-inch.
			2 5-inch.
Boston	Cruiser	3,189	2 8-inch.
			6 6-inch.
Atlanta	Cruiser	3,189	2 8-inch.
			6 6-inch.
Dolphin	Dispatch	1,485	1 6-inch.
Newark	Cruiser	4,083	12 6-inch.
Charleston	Cruiser	3,730	2 8-inch.
			6 6-inch.
Baltimore	Cruiser	4,413	4 8-inch.
			6 6-inch.
Philadelphia	Cruiser	4,324	12 6-inch.
San Francisco	Cruiser	4,083	12 6-inch.
Yorktown	Gunboat	1,700	6 6-inch.
Petrel	Gunboat	890	4 6-inch.
Concord	Gunboat	1,700	6 6-inch.
Bennington	Gunboat	1,700	6 6-inch.
Vesuvius	Cruiser	725	3 15-inch dynamite guns.
First class torpedo boat	Torpedo	99	8 automobile torpedoes.

The Texas has an armor 12 inches thick and the Maine one 11 inches thick. The other ships are unarmored. The building of a coast defense vessel of 4,000 tons displacement, four additional steel cruisers, and three gunboats has been authorized by Congress. When all the vessels enumerated above shall have been completed, the United States will have a navy of thirty-six iron and steel vessels, all, excepting the five monitors, built on the most approved modern plans. This fleet will consist of eighteen cruisers (including two dynamite cruisers and a cruising monitor), one dispatch vessel, six gunboats, one torpedo boat, seven coast or harbor defense vessels (including the five monitors), two line-of-battle ships, and one training ship. Eleven ships of the fleet, including the monitors and two of the cruisers, will be armorclad.

AN IMPROVED FISH TRAP.

The accompanying illustration represents a fish trap recently patented by Mr. Elijah W. Jenkins, of Milford, Mo. The frame has slatted side walls and a central cross piece, while in the corner post are held vertically movable slatted end walls, connected to the arms of a rod, the center of which is bent to form a lever, by pressing down upon which the end walls may be elevated to permit the entrance of the fish. Wires are hinged to the inside of the frame in such way that the



JENKINS' FISH TRAP.

fish may swim into the trap under the wires, when the wires will drop down and prevent the escape of the fish. Wire netting and converging wires are also provided on the inside of the frame to prevent the fish from swimming through the trap. To the central cross piece of a false bottom of the trap is pivoted a vertical rack bar, passing up through the upper cross piece, on which is a gear wheel secured upon a crank shaft, by turning which the false bottom and also the two end frames may be drawn up, the slatted end walls being at such time lowered to prevent the escape of the fish. For further information address Mr. G. B. Peter, agent, Milford, Mo.

THE TOTAL ECLIPSE OF THE SUN AT LICK OBSERVATORY.

Professor Holden, Director of the Lick Observatory, is preparing an elaborate report upon the result of the observations made during the total eclipse of the sun in the latter part of last January. This will be looked for with special interest. We have been fortunate enough to procure one of the photographic negatives made at that time, which we reproduce by photo-engraving process. It is printed as a positive in order that the form and extent of the sun's corona may be represented in black, thus defining more clearly the delicate penciling of the rays of the corona. In a letter published in the San Francisco *Call*, Professor Holden says:

"The first result of the photographs has been to show that the characteristic forms of the solar corona vary every eleven years, as the sun spots and the exhibitions of the aurora borealis vary in frequency. Besides this capital conclusion, the photographs enable us to conclude that the so-called polar rays of the corona can be traced all round the sun's circumference, even at the equator, and thus that we must consider these polar rays (so called) as a special typical form, quite different from the other class of rays which they resemble in appearance, but which are only to be found associated with the equatorial wings and extensions of the outer corona.

ECLIPSE OF THE SUN IN CALIFORNIA.

"So far as I know, no photograph of the corona has traced these wings further from the center than fifty minutes of arc. Out to that distance they seem to be convergent and to indicate that they quickly come to an end. Mr. Barnard's photographs, however, show faint extensions as far out as seventy-five minutes of arc, and it is evident that the outer corona, instead of quickly terminating, must extend far into space. The pictures show this divergent outer extension in a form like that of a fan, or like the open mouth of a trumpet. This, of course, indicates that the outer corona is in the shape of a huge disk, surrounding the whole sun, with its outer rim much deeper than its inner one. In fact, if the sun were surrounded by a ring of meteorites, the appearances would be much the same as in the photographs." In two photographs the outer corona is distinctly defined as far out as the 95' circle, and may be indistinctly traced as far as 135 to 165 minutes respectively.

War Ships Launched in 1888.

According to a careful estimate, the number of war vessels launched last year by the naval powers of the world was 60, while more than 100 were building when it closed. England led, with 15 vessels launched and 28 building; France launched 9, and laid down 15; Russia launched 2, and began 10; Germany put 6 vessels into the water, and ordered or laid down 4; Italy launched 10, and laid down 18; Austria launched no vessel, but laid down or ordered 3; Sweden laid down 1; Denmark launched 1, and laid down another; China added 4 vessels to her navy, and ordered or laid down 4 more; Japan ordered 3, and launched 3; the United States launched 6, and laid down 6; Chili ordered a new cruiser in England, and the Argentine Republic contracted for a 4,300 ton ironclad; Brazil laid down a cruiser, and even Uruguay has contributed to the navies of the world, launching a small iron gunboat. The minor powers, like Greece and Portugal, have either contracted for or launched small vessels. Turkey has begun the work of building up her navy, laying down one ironclad and several smaller vessels.

Increasing Longevity.

Dr. Todd, president of the Georgia State Medical Society, read at the annual meeting of that body, held at Atlanta recently, a paper on "Longevity," which possesses great intrinsic interest and at the same time is gratifying as showing how much medical and sanitary science and a more rational mode of life have done to prolong the human span, and how much better in every way are the conditions of to-day than of those "good old times" for the return of which sentimentalists vainly sigh. The doctor is modest in his claims, making no effort to monopolize in the name of the medical profession credit for a betterment in which so many agencies play parts; but he does claim, and with reason, that the intelligent physician has had much to do with the result, and that the death rate of the various peoples of the globe bears a ratio very nearly inverse to the number of qualified physicians among them. The highest death rate in Europe is that of Russia, ranging from 20 per thousand in Courland and 22 per thousand in the Baltic province, there being many physicians in both districts, to 49 in places where there are but few. But one-half of the children born in some parts of Russia reach the seventh year, and of 1,000 male children only from 480 to 490 reach the age of 21 years, and of these only 375 are able-bodied. Russia, with all its teeming population, has only 15,414 regular physicians, and one surgeon to 100,000 population. The United States, having a doctor of medicine for every 600 population, shows the lowest death rate in the world, England following. The average life expectancy in the United States is now 55 years; in England among the urban population it is 50, and among the ruralists 54 years plus. Russians have a life expectancy of but 28 years, approximately, and Chilians of the same, while in Ellobed, in the Soudan, 23 years is a generation. The average life in the Rome of the Cæsars was 18 years; now it is 40 years. Within fifty years the average in France has increased from 28 to 45½ years, and in the days of Queen Elizabeth the English average was but 20 years. Dr. Todd ascribes the great and progressive change for the better to advanced medical knowledge, better drainage and diet, greater cleanliness, and to vaccination and the use of anæsthetics, quinine, and the like. He thinks that quinine alone has added two years to the average life of civilized man. To these agencies should be added the decrease of war, the more lenient laws, and the greater temperance of our day.—*Detroit Free Press.*

A Partnership Birds' Nest.

Mr. W. E. Beale writes from Folkington Manor to the *Times:* "On this estate is to be seen a nest which has evidently been built partly by a thrush and partly by a hedge sparrow. The nest itself is of the ordinary size of the thrush's nest. But instead of being lined with mud, it is lined with horsehair, wool, and moss. The birds seem to have been good friends during the laying of their eggs. Recently there were three sparrow's eggs in the nest and five thrush's. But on visiting the nest later, it was found that the sparrow's eggs had been destroyed. The birds appear to have quarreled when it came to the question of which should sit on them, and the thrush asserted its rights, not, however, without a struggle on the part of the sparrow, one of the thrush's eggs being broken, one missing, and three being perfect."

Woman's Place in Nature.

Mr. Grant Allen propounds in *The Forum* a new view of "Woman's Place in Nature." "The males," he says "are the race; the females are merely the sex told off to recruit and produce it. All that is distinctively human is man—the field, the ship, the mine, the workshop; all that is truly woman is merely reproductive—the home, the nursery, the schoolroom." "This very necessity for telling off at least a considerable number of the women for the arduous duties of human maternity prevents the possibility of woman, as such, ever being really in any deep sense the race. It is human to till, to build, to navigate, to manufacture; and these are the functions that fall upon man." "The males have built up human civilization and have made the great functionally acquired gains in human faculty, while the females have acted as mere passive transmitters of these male acquisitions."

AN IMPROVED AUTOMATIC INJECTOR.

An injector which is exceedingly simple in operation, and designed for use on any kind of boiler, is shown in the accompanying illustration. In operation it should always be placed in horizontal position, as shown, and the steam and suction pipes supplied with globe valves. Its construction and operation will be readily understood from the sectional view. When an examination of the parts is necessary, it can be readily taken apart

DESMOND'S AUTOMATIC INJECTOR.

with an ordinary monkey wrench and screw driver. This injector, it is said, can be started with 20 pounds of steam, and works up to 145 pounds without adjustment, it being adapted to work up to 200 pounds. It is claimed that a hot suction pipe will not prevent the injector from starting readily, and that severe jarring will not affect its working, its automatic qualities restarting it if the feed is temporarily stopped. This injector was invented and perfected by John Desmond, and is manufactured for Messrs. Jenkins Brothers, 71 John Street, New York City.

Air Compressor Lubrication.

Our attention is called to the importance of care in the selection of lubricators for air compressing plant, by a paper recently read before the North of England Institute of Mining and Mechanical Engineers by Mr. Morison. In recent years in England there have been two explosions of receivers of compressed air, which undoubtedly occurred from the ignition of vapor from the oil used in lubrication, and a third case where the excessive heat in the pipe indicated that ignition had commenced, and an explosion was no doubt only avoided by this discovery before the vapor generated from oil collected in the receiver came in contact with the actual ignition. There were also, at least, one if not two cases of fire at the works on the Croton Aqueduct traceable to the same cause.

The first of these accidents referred to is described as follows: The air compressor supplying the receiver in question was working at a pressure of 57 pounds per square inch, and the receiver consisted of a cylindrical shell with hemispherical ends, the shell being 29 feet long and 6 feet in diameter. The receiver was close to the air compressor. On the night of the accident the attendant had oiled the air cylinders shortly before the explosion occurred. The explosion was accompanied by a loud report, and a large volume of flame was observed to shoot upward and shortly subside, but left some oily matter inside the receiver burning. The flashing point of the oil used here was discovered by the committee appointed to examine into the circumstances to be 365° F.

The conditions of the other explosion were similar to the first, and in the third case referred to, the flashing point of the larger part of the oil was found to be 295° F., and it was found to be a mixture of thickened cottonseed oil, heavy mineral and light mineral oils. The heavy mineral oil by itself had a flashing point of over 480° F., and was therefore safe if used alone. In this case the receiver was distant from the compressor, and the excessive heat arising from the ignition of the oil collected in the pipe was fortunately discovered where the volume of air was too great to allow of an explosion and before it had traveled to the receiver. The pipe was 6 inches inside diameter, of cast iron, with flanged joints, the joint being made with India-rubber insertion screwed up between the flanges. The receiver was 50 feet from the compressor, and the air compressed to 50 pounds per square inch. The temperature of the air leaving the compressor, when used up to 50 pounds per square inch, was found to be from 320° to 370° F. Two of the pipe joints between the compressor and receiver began to blow, and sparks were blown out, and the pipe in the vicinity of the joints was found to be nearly red hot, and on subsequent examination a charred deposit was found inside the pipe, being the residue of the lubricating oil. The point of ignition of these oils, or, rather, the vapor from them, was apparently not ascertained, and in this respect the report of the committee appointed seems strangely deficient.

There are, however, some very distinct conclusions to be drawn, and which may be laid down as rules which are no doubt attended to by careful users of compressing plant, but which should be adhered to by all. The air receiver should be blown off daily to prevent accumulation of oil in such quantity as to generate a dangerous volume of vapor, and more important still, only pure lard oil, or such special lubricator as is supplied by responsible firms for the express purpose, should be used, and if there is the slightest doubt as to the quality of the article supplied, its flashing and ignition points should be ascertained.—*Eng. and Min. Journal.*

Brains in Business.

One great secret of success in business—the secret, in fact, of success on a large scale—is to conceive of it as a matter of principles, not merely as a series of transactions. There are great merchants as there are great statesmen, and there are small merchants as there are small politicians, and the difference between the great and the small men is very much the same in both professions. The small politician works by the day, and sees only the one small opportunity before him, the small merchant does the same thing—he is looking for the next dollar. The statesman, on the other hand, is master of the situation because he understands the general principles which control events; this knowledge enables him to deal with large questions and to shape the future. The great merchant does the same thing, his business is not a mere money-getting affair, not a mere matter of barter, but a science and an art, he studies the general laws of trade, watches the general conditions of the country, investigates present needs, foresees future wants, and adapts his business to the broad conditions of his time and place. He puts as much brains into his work as does the statesman, and he ends by being, not a money getter, but a large minded and capable man. An eminently successful business man, of the statesmanlike quality, said the other day that the more he understood of life, the more clearly he saw that it was all done on business principles. By which he meant, not only that the universe stands for the dollar, but that the universe is governed by unvarying laws, that promptness, exactness, thoroughness, and honesty are wrought into its very fiber. On these business principles all life is conducted—if not by men, at least by that Power which is behind man. It ought to be the ambition of every young man to treat his business from the point of view of the statesman, and not from that of the politician.—*The Christian Union.*

Quartz as an Insulator.

Mr. C. V. Boys lately read a note before the London Physical Society. He stated that when making quartz fibers by the process described by him some time ago of shooting an arrow carrying with it a kind of tail of softened quartz, he had observed that, when the fibers were very fine, if they broke off between the bow and the target the extremities assumed the form of a screw about half an inch in diameter and some eight or ten inches long. If any body were brought near this screw, the end of it would shoot out toward the surface of the body, retracting again when the body was removed. It hardly appeared possible that this could be due to any other cause than to the fiber becoming in some manner electrified during its formation. If, however, this were the case, it would show that quartz must be an exceptionally good insulator under ordinary atmospheric conditions, for otherwise the extremely minute charge which could be carried on so fine a fiber would be dissipated almost as soon as it was generated. It was, of course, quite impossible to obtain any direct proof of the existence of so small a charge beyond that given by the behavior of the screw when any substance was brought near to it. He therefore determined to test the insulating power of quartz under ordinary atmospheric conditions, and he found that quartz is under any circumstances a better insulator than glass, and that under the ordinary atmospheric conditions there was no comparison between them. This was very well shown in an experiment which Mr. Boys exhibited to the society. A pair of gold leaves had been suspended by means of a hook formed out of a thick quartz fiber, inside a case with glass ends, and had been electrified about five hours before the time of meeting. In order to make the conditions as unfavorable as possible, the air within the case was kept moist by placing a glass dish full of water inside it, and the quartz hook was made very short. When the experiment was exhibited, the deflection of the gold leaves had only diminished by about one-fourth of its original amount. If glass had been used as a support for the leaves, the electrification would have been entirely dissipated in considerably less than a minute.

Straightening Walls of Buildings.

D. LARDNER.

The weight of the roof of the large gallery of the Conservatoire des Arts et Metiers pressed the sides outward so as to endanger the building; and it was requisite to find means by which the wall should be propped so as to sustain the roof. M. Molard contrived the following ingenious plan for the purpose. A series of strong iron bars were carried across the building from wall to wall, passing through holes in the walls, and were secured by nuts on the outside. In this state they would have been sufficient to have prevented the further separation of the walls by the weight of the roof, but it was desirable to restore the walls to their original state by drawing them together. This was effected in the following manner: Alternate bars were heated by lamps fixed beneath them. They expanded; and consequently the nuts, which were previously in contact with the walls, were no longer so. These nuts were then screwed up so as to be again in close contact with the walls. The lamps were withdrawn, and the bars allowed to cool. In cooling they gradually contracted, and resumed their former dimensions; consequently the nuts, pressing against the walls, drew them together through a space equal to that through which they had been screwed up. Meanwhile the intermediate bars were heated and expanded, and the nuts screwed up as before. The lamps being again withdrawn, they contracted in cooling, and the walls were further drawn together. This process was continually repeated, until at length the walls were restored to their perpendicular position. The gallery may still be seen with the bars extending across it, and binding together its walls.—*The Architect, London.*

A Great Well in California.

M. R. Rose, of the Capital Iron Works, of this city, has bored a well on R. D. Stephen's place, near Mayhew Station, which is the largest in this section of the State. It is 32 inches in diameter and 120 feet in depth. It is not only the largest bored well in the State, but it furnishes more water than any other. In fact, it is an inexhaustible reservoir that cannot be lowered. A sixty horse power engine works a large centrifugal pump, that throws over 32,000,000 gallons per day—more than our city water works pumps in a whole week, and what would measure in a ditch or canal over 1,000 miner's inches. So strong is the supply that this immense volume does not in the least lower the source of supply, and the water is as clear and pure as any obtainable.—*Sacramento (Cal.) Record-Union.*

American Wood Engraving.

BY H. E. M. SUYERKROP.

English and Scotch manufacturers of machinery are beginning to find out that (notwithstanding their proverbial prejudice to many things American) their catalogues can best be illustrated on this side of the Atlantic, and many firms are now not only getting the engraving done in this country, but also the printing.

Printers and engravers across the water are slow to adopt new methods, thinking that "good enough" will do. "What was good enough for our fathers and grandfathers is quite good enough for us," they say. But it is not the man who does the work alone that must be pleased—it is the person for whom the work is done. They are too shortsighted to see this, and rather than move out of the rut they have been taught in, and try and improve their work by the adoption of machines and other modern appliances, they allow the work to slip from their hands to take a journey of 3,000 miles and back.

An English wood engraver as a rule is a mere machine, copying or cutting literally what is drawn for him on the block by a draughtsman, the American method of engraving from a photo. direct on the wood being almost unknown to them. No photograph of a piece of machinery, however well lighted, would look well as an engraving if copied literally. Lights must be taken out, solid blacks put in, and the whole must be actually redrawn, as far as the shading is concerned, with the graver. Therein lies the skill of the American engraver. Although the photo. is flat and devoid of correct light and shade, the final print from the finished cut will be bright, clear cut, and sharp, with a sparkle and snap to it that is not excelled even by work cut from the most finished drawing on wood.

One has only to compare the cuts in foreign machine catalogues with those of our own to see how far they are behind us in the matter of engraving machinery. Examine the shading of the one, and the lines will be found uneven and broken, devoid of contrast and that fineness and even quality so peculiar to work of the other, which is invariably ruled by machine. The ruling machine is a most delicate piece of mechanism, capable of making lines so fine that they cannot be counted without the aid of a strong magnifying glass, making straight, circular, wave, and perspective lines with absolute precision, that could not possibly be cut by hand. Improvements in the art of photography of late years have done much to assist the engraver in his work. Fifteen years ago engravers had to cut through a thick film of albumen on the surface of the wood, put there to prevent the nitrate of silver from sinking into the block. This film or coating would chip and peel off, making the lines ragged and uneven, causing no end of trouble to the electrotyper and printer.

It was due to the genius of Mr. J. M. Blake, of New Haven, to overcome this difficulty by an invention of his own. Mr. Blake made a positive on glass by the old collodion process. This film he floated off the glass silver side down, on the block, afterward dissolving off the collodion with alcohol and ether, leaving a fine, clear print on the wood that offered no resistance to the point of the graver. Since this valuable discovery engravers have been little troubled with bad photos. on wood.

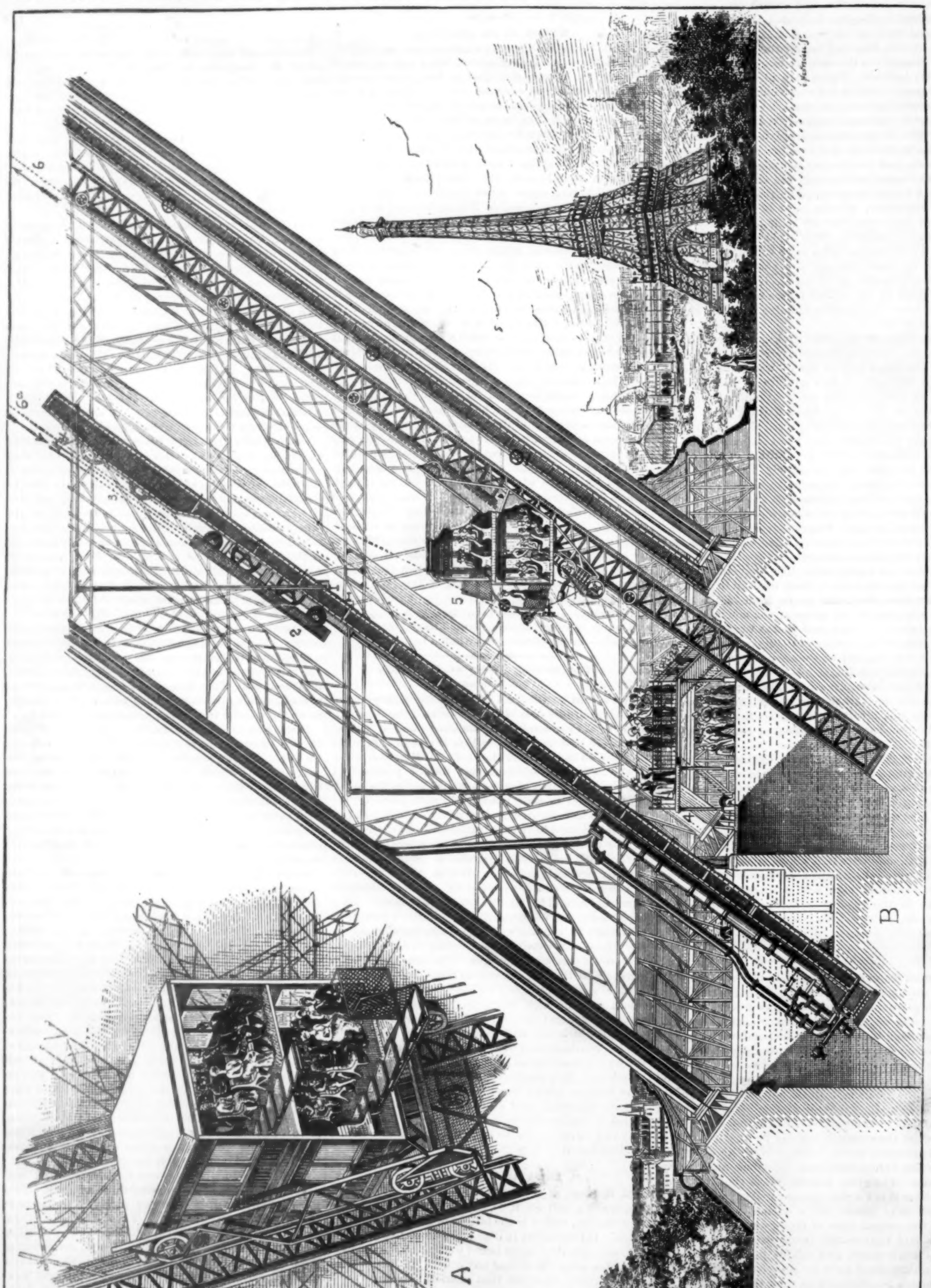
Every engraver should have a camera and know how to use it, as few professional photographers can make negatives suited to the requirements of the engraver, and it is also a great aid to be able to draw. One who can draw well rarely makes a mistake in his cutting and can easily cut from a photo., while on the other hand if unable to draw he must rely on a draughtsman to retouch his photo. on the block or engrave from drawings altogether. It is impossible to draw a line with a pen as clean and sharp as it can be cut. This fact has in a great measure prevented wood engraving, especially of machinery, from being superseded by the various photo-mechanical and chemical methods of reproducing, for it is a misnomer to call them engraving. Every line must be drawn and be absolutely black, and all the spaces between the lines must be pure white in order that a perfect negative may be obtained. This drawing alone often takes more time than to engrave the same on wood, and when finished must go through many intricate processes before the final plate is ready for the printer.

Photo-reproduction of course has its uses, but will never supersede wood engraving for machinery. This no one knows better than the printer. Imitation is the sincerest form of flattery. The Germans have to a great extent abandoned the old laborious method of cross hatching and putting in useless, meaningless lines. Many of their illustrated periodicals have taken up the American style in landscape, figure, and portrait work, but they and their brethren on the little isle to the north have still much to learn from us in the way of mechanical work, and it will take much study and many a long day of constant application ere they can begin to equal us in this line.—*Practical Mechanic.*

THE OTIS ELEVATORS AT THE PARIS EXPOSITION.

The fact that hydraulic passenger elevators of this well-known American type are to be used in the 1,000 foot high Eiffel tower at Paris is a matter of satisfaction to all who watch with interest the progress constantly being made by our mechanics and inventors. There are two of these elevators to be used, in two of the four legs of the tower, rising to the height of 420 feet and we recently noted the fact of the shipment of 800,000 pounds of machinery to run them, which was all made at the company's factory, at Yonkers, N. Y. A general view of their operation is shown in the accompanying illustration, from the *London News*.

There are three systems of elevators to be used in the Eiffel tower. From the ground to what may be called the first story, where great restaurants will be established, there will be four elevators, two of the Otis pattern and two of the system of Roux, Combaluzier, and Lepape, in which the car is elevated by means of a jointed piston, which has been compared to a vertebral column. From this story to the next one, about 400 feet from the ground, the Otis elevators only are employed, in two of the legs of the tower. The cars of the French system in the two bottom lifts are adapted



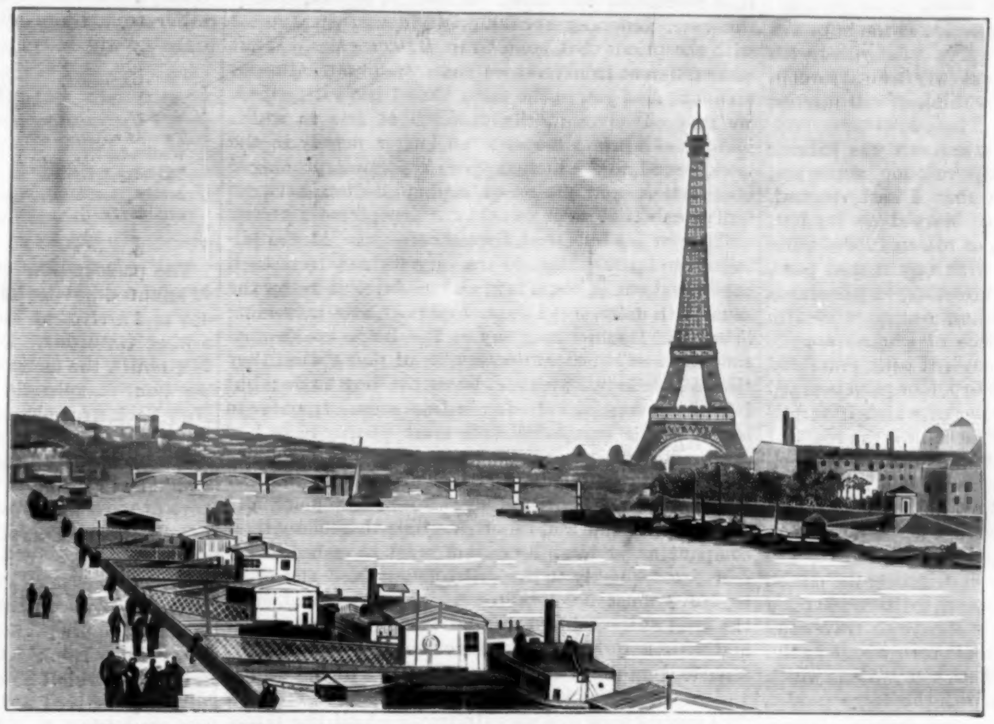
A. View of car for fifty passengers, with front removed, showing interior. B. General view of one leg of the tower at the base, showing the actual incline. 1. Hydraulic cylinder. 2. Traveling multiplying pulleys. 3. Stationary multiplying pulleys. 4. Double landing platform. 5. Car ascending, moving on trucks, at angle shown, to first story, where, rounding a sharp curve, it continues on different angles to second story, rising 430 feet in one minute. 6. Cables lifting car. 6A. Same cables returning to cylinder. C. The Eiffel tower, 1,000 ft. high.

THE OTIS ELEVATOR IN THE EIFFEL TOWER OF THE PARIS EXHIBITION—BUILT BY THE AMERICAN ELEVATOR COMPANY, LONDON AND PARIS.

to carry one hundred passengers each, while the cars of the Otis elevators carry only fifty each, but their speed is double that of the others. The top lift, a vertical distance of 493 feet, is made by elevators on the Edoux system, in which the carriage is worked by an enormous piston. Those who go above this distance to the lantern will have to climb a spiral staircase.

The total height of the tower is 984.24 feet, or 300 meters, but the inclined or curved part of the legs considerably increases the length of travel of the elevators in these portions, a vertical height therein of 372 feet making an actual length of the curved part of 493 feet. The angle of inclination in this portion varies from 54 degrees at the start to about 80 degrees at the finish, but the carriages are so hung as to always accommodate themselves to the varying angle, so that their floors will be kept even. The steps leading to the different landing places are made to fold up when the car is traveling.

The great hydraulic cylinder of the Otis elevator, which is placed in the foot of the tower, perpendicularly to the cross pieces, is 38 inches in diameter and 41 feet long, while the circulating pipe, valve, and water chest are all 9 inches in diameter. In this cylinder is a piston fed with water from reservoirs placed on the stage where the vertical portion of the tower commences, or at a vertical height of 372 feet above the lower end of the cylinder. The piston rod operates on a carriage bearing guide wheels and multiplying pulleys, cables thence connecting with stationary multiplying pulleys, and the carriage being suspended by six ropes of steel wire. One of these ropes alone is designed to have sufficient strength to bear the carriage full of passengers without breaking. The carriage is partly counterbalanced, and rises or falls twelve feet for one foot movement of the piston. Under the cabin is a safety brake, with the jaws working automatically in case of rupture or of the elongation of one of the ropes.



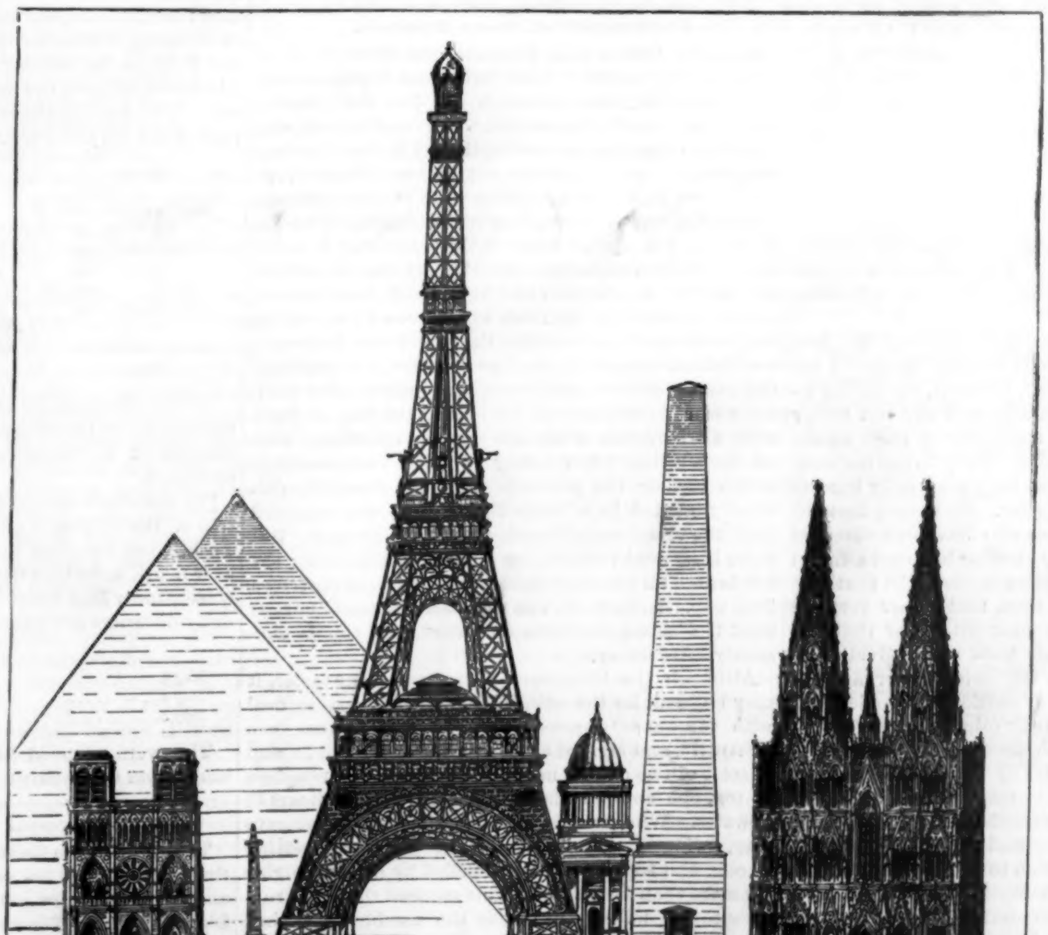
ASPECT OF THE EIFFEL TOWER AT A DISTANCE OF TWO MILES.

THE EIFFEL TOWER.

One of the most notable objects of this year's exposition in Paris will certainly be the Eiffel tower, named for the constructor Eiffel, and finished March 31. The reader knows that this immense and bolt iron structure, which is 984 feet high, is by far the highest building in the world. In the accompanying illustration we show the Eiffel tower in connection with some of the highest structures of the world, all being drawn on the same scale. Only by such a comparison as is made possible by this cut can one realize the size of this new wonder of the world.

The highest structures of ancient times are the pyramids of old Egypt, the highest and best preserved of which are the pyramid of Cheops, near Ghizeh (450 feet high), and that of Chephren (448 feet high). Both of these are less than half as high as the Eiffel tower. Heretofore the highest building in Europe was the Cologne cathedral (about 522 feet high), and the highest in America the Washington monument (about 555 feet high). Both are greatly surpassed in height by the Eiffel tower.

To give the reader an idea of the comparative heights of the Eiffel tower and the buildings nearest it, we have shown in the picture a few of the highest structures in Paris, viz., Notre Dame (223 feet high), the dome of the Pantheon (272 feet high), and the Column Vendome (144 feet high).—*Illustrirte Zeitung.*



THE EIFFEL TOWER.

THE UNIVERSAL EXPOSITION OF 1889.

Without having seen it for one's self, it would be impossible to imagine the amount of work that has been done in two years at the Esplanade des Invalides and Champ de Mars, which are connected by a covered gallery on the bank of the Seine. The Universal Exposition of 1889 will be the greatest and the most imposing manifestation of human industry that has ever been carried out up to the present. The entire world will figure in it, and the representatives of all countries will come to it in a crowd.

On passing through the structures accumulated here and there, and the innumerable galleries, and on visiting the machinery palace, and admiring the Eiffel tower, that dominates the whole, we could not repress a genuine feeling of patriotic joy; for the exposition will be a triumph for France and for Paris.

The Esplanade des Invalides will offer a peculiar attraction to the visitor, and everything that he sees there will prepare him in some measure for the wonders of the Champ de Mars. A multitude of varied buildings form here, as a whole, a most attractive sight. Among them is the palace of the Minister of War, with the military exhibit. The palaces of the Tunisian and Algerian sections opposite it are also most remarkable, though less monumental. Alongside of these structures an edifice is reserved for the administration of post offices and telegraphs; further on there are other structures designed for the exhibition of the Dutch Indies and of the islands of Java and Sumatra; then come the pavilions belonging to the sections of the French colonies—Cambodia, Annam, Cochin China and Tonkin, etc.

On the Invalides side, we may mention the large building of the panorama of Paris and, at the other extremity, the gastronomic pavilion. And now let us leave this spot, already so well filled, in order to cast a glance over the Champ de Mars.

Among the structures of the Champ de Mars, two will be especially beautiful. We mean the machinery palace and the 300 meter tower, the effect of the latter of which is absolutely grand and majestic. The machinery palace is entirely finished, as far as the architectural part properly so called is concerned. The supports for the shafting are placed upon their beton foundations, and some days ago a beginning was made toward moving in the host of machines which are to animate this immense structure, the largest that has been built up to the present, and which does honor to its engineers, its architects, and its decorators.

At the right of the Champ de Mars rises the palace of liberal arts, and, to the left, the palace of fine arts. Twenty years ago, either of these structures would alone have nearly sufficed to contain a universal exposition. Between the two palaces are laid out gardens that are to be illuminated at night with floods of electric light, and in the center of which luminous fountains will play. A little beyond these two palaces are the pavilions of the city of Paris, where the visitor will enter the galleries of the various groups by passing under a central dome of very majestic proportions.

In front of the Champ de Mars, the Eiffel tower, placed upon its four iron pillars, forms the arch of triumph of science and industry. Its aspect, now that it is finished to its definite height, can be judged of and appreciated. Its early detractors are mute, and the approbation of engineers and artists is unanimous. When regarded from a distance, the 300 meter tower appears graceful, slender, and light. It rises toward the heavens like a delicate lattice work of wires, and, as a whole, it is all full of poesy. When it is approached, the structure becomes monumental, and when the base of the colossus is reached, the spectator gazes with admiration and meditation at this enormous mass, assembled with mathematical precision, and forming one of the boldest works that the art of the engineer has ever dared to undertake. This surprise increases when he ascends the staircases of the tower. Before reaching the first story, he traverses forests of iron uprights, which offer fantastic entanglements; then, in measure as he ascends, he is astonished at once at the immensity of the structure, its apparent lightness, and the splendor of the panorama that it permits of contemplating. Apart from the undoubted interest that attaches to the Eiffel tower, as much from the standpoint of its metallic structure as from that of its height, we can now no longer deny that the gigantic work is absolutely beautiful.

Sunday, March 31, while descending the tower stairs after the ceremony of placing the flag upon the summit of the cupola, we had the pleasure of hearing one of our most distinguished members of the Academy of Sciences exclaim that this iron monument was

certainly the most astonishing production of our age. It is for our epoch, he said to us, what the great pyramid, which interprets the efforts of an entire people, was for the ancient world. All the resources of contemporary art have had to concur in its execution. The work that Mr. Eiffel will have had the glory of carrying out is, in fact, the expression of the applied science of our time.—*La Nature.*

The Habits of Ants.

Although the following fact relative to the habits of ants is well known, I have never seen it described with the marked characters and in the clearly defined form in which I have just observed it. I think it will interest the readers of this journal.

Saturday, July 14, 1888, while the sun was shining brightly, I was walking on a road running north and south, and which, at a point that I had reached, skirted a garden wall. I soon observed at my left, toward the wall, a whole legion of brown ants of quite a large size that were moving with a quickened pace, and in good order, in the same direction. The column was about 8 inches in width and nearly 16 feet in length. It started from a piece of ground a little higher than the roadway and covered with grass and weeds. From this it descended by a foot path inclined more than 45 degrees, at the center of which it turned abruptly at right angles in order to follow the road. I quickened my pace and reached the head of the column, which was very sharply defined, and followed it attentively in order to see what could be the object of the expedition, for it was clear that it was a question of the carrying out of a well determined plan. I had already remarked with surprise that, during the march of this army, several ants, seeming to have changed their mind, were retracing their steps and traversing all the ranks; but I soon saw them turn about again, after advising with some of their companions which they had sought. Having reached the large garden gate, the head of the column stopped, and all the new comers grouped themselves in a circle of wide diameter. It was evident that the ants had united in a council of war, and that they were debating upon some plan of prudence to follow. The circle, in fact, soon opened, and the ants began to pass under the leaves of the gate, no longer in a serried column, but scattered over a wide space, and walking more slowly and with deliberation. I saw them move in the direction of a grass plat, and here I lost sight of them. I was feverish that day, and out of humor, and I walked along gloomily, thinking of what I had just observed. I thought it was some unfortunate colony that had exiled itself from its domicile in order to seek more propitious skies. I was thoroughly deceived. I had just witnessed a premeditated pillaging expedition.

Returning by the same route in the course of half an hour, I saw my ants triumphantly starting for home, each holding in its mandibles a large ant's egg, doubtless of another species. Each was proceeding on its own hook, and endeavoring not to lose its prey. Was it, in fact, prey that they had just sought for their table, by a barbarous refinement of taste? Or was it, rather, eggs that they wished to have hatched in their own domiciles in order to convert the young ants into slaves, of which, by a just retribution, they in turn would become the slaves, by losing the habit of working? Was it an odious act of rapine and violence that I had just witnessed, or must we admit that ants thus deprived of their progeniture willingly resign themselves to their fate and are predestined thereto? At all events, the defense, if defense there had been, could not have been very energetic. The pillagers were not pursued, and not a wounded individual appeared among the victors.

The first part of the drama had saddened me, but had left me with a false notion; the end saddened me more yet. I consoled myself, however, by saying to myself that if these slave-making ants are not better than their similars among men, they at least understand their true interests better. They do not maltreat their victims very much, since they eventually become the humble vassals of the latter. And then, thought I, too, perhaps the naturalists who have well observed these captures of one race by another have not awaited the end. Ants of a large brown species exist that capture eggs, and it must be, then, that either they are not robbed of their entire progeniture, or that the slaves some day or another go back home, dividing in their turn the victors of the day before. Perhaps one of these days I shall see a procession of smaller ants proceeding quietly toward their original abode.

Since the epoch in which Descartes, by an inspiration (this time inauspicious) of his genius, tried to reduce animals to the state of machines, and in which Malebranche, his fanatical disciple, carried this idea to the point of extravagance, and since the epoch in which Buffon, in contradiction to his pompous tirades on the qualities of the dog, horse, etc., endeavored to prove that all is instinct and mechanism in the animal, a considerable progress has been made in this line of questions. No more than any astronomer to-day disputes the plurality of the worlds does any naturalist longer dispute the manifestations (often very elevated) of intelligence, reasoning, and other psychical faculties, not in the animal kingdom taken in a lump, as done by many persons in order to deny the fact more easily, but in certain species and certain individuals of such species. Man being considered (by himself, be it understood) as the highest type of animate and living nature, it might be thought that these inferior beings, which, in certain respects, are comparable to him, would be the very ones that, by their organization, resembled him most. Although, in fact, that is the case, generally speaking, we nevertheless meet with exceptions that seem to us true enigmas. What more different from our own than the organization of an ant? And yet, in the scene that I have described, we find ourselves in the presence of acts in which instinct as a prime mover is no longer merely in the background, and which suppose reasoning, prolonged observation, and means of communication between individuals that no one would have suspected *a priori*.

The two ant hills that I speak of—those of the pillagers and the pillaged—are very distant from each other, and one of them is in an inclosure. I follow the same path daily, but I never observed ants traversing it before. Instinct may say to the large brown ants that there exist other ants capable of doing what they themselves do not wish and know not how to do; but here the revelations of such instinct stop. In order to satisfy it, the *incapable* ants must plainly have had explorers to go to a distance to look for a colony of workers, to boldly enter the latter's quarters in order to see when the laying of eggs would take place, and then return home and report the time thereof to their companions. Such information must have been communicated quickly to the entire colony, and the order to move must have been perfectly understood, since the head of the column was advancing in good order and with a quick pace. Moreover, this legion must have had guides that were very sure of their business and of the objective point to be reached. The ants that turned back and quickly traversed all the ranks, to see if everything was proceeding according to rule, probably knew that among their kind, as among our own, intelligence and the sentiment of duty are not the same with all. The council of war held in the circle before the attack of the camp to be pillaged is a proof of a well-reasoned prudence. No unwise head in command said: "All is ready."

In what precedes, I do not intend to teach the reader anything new. He will find in the well written work of Brehm some remarkable observations on the habits and aptitudes of ants. The reason that I have entered at some length upon this subject is because I had never seen a succession of acts more varied displayed among these little creatures, and all combining to lead the spectator to the same forced conclusion. To have seen nothing but mechanism and blind instinct in the scene that I witnessed, I should myself have had to be endowed with scarcely anything else than these two motors. The reader will certainly join me in this conclusion.—*G. A. Hirn, in La Nature.*

Great Speed of Ocean Steamers.

The new Inman and International liner City of Paris recently completed her first round voyage to and from New York, and although she has not exactly broken the record, she has done remarkably well, and gives every promise of accomplishing the task which, by general consent, has been set to her. The following is from *Engineering*. First trips of fast steamers are usually very commonplace performances, by reason of the many stoppages made in the machinery to bring about desirable changes dictated by the experience gained from day to day, and it was not therefore expected that the City of Paris would even do so well as she has done. It is true that the record was broken in her maiden voyage by the America, the production of the same eminent naval architects and marine engineers who have designed the hull of the City of Paris with all its grace of outline and the machinery with all its novelties; but owing to these very novelties, which include the principle of forced draught, previously untried in a large liner, it was not expected that the vessel would break the record at once. But there is no need to apologize for her performances; she has beaten all previous maiden voyages, and that by a long way. Indeed, she was within a couple of hours or so of the fastest run home on record, and this is eminently satisfactory.

Although the homeward journey was the faster, it may be well for the sake of consecutiveness to deal with the outward passage first. She left Queenstown on April 5, and arrived at Sandy Hook on April 11, and in spite of two days of heavy wind and sea and two days of fog, she covered the distance in 6 days 18 hours 53 minutes. When three days out the port engine gave way, owing to the packing of the piston rod getting wrong, and the vessel was propelled by her one engine for more than five hours. This reduced the day's running to 390 miles. Otherwise the machinery worked very well, and it is noteworthy that the amount of coal consumed was even less than in the case of the City of New York. It is very satisfactory to note that toward the end of the journey the speed gradually increased, presumably due to greater confidence on the part of the engineers, and consequently more being taken out of the engines. The steaming of 498 miles within the last complete 24 hours of the voyage is a guarantee of the capabilities of the vessel. In giving the daily runs of the City of Paris we give also the runs of the Etruria on her fastest trip, made in June, 1888, with the remark that she has had several years' running, and has improved with age, so that it is not exactly for comparison that we give the figures, but rather to indicate what the City of Paris must and probably will do before long.

ETRURIA.	Miles.	CITY OF PARIS.	Miles.
Monday	455	April 5	378
Tuesday	456	" 6	415
Wednesday	496	" 7	402
Thursday	485	" 8	390
Friday	503	" 9	410
Saturday	457	" 10	498
		" 11	344

The passage time of the Etruria was 6 days 1 hour 47 minutes, having left Queenstown at 1 P.M. on Sunday and arrived at Sandy Hook 10:25 P.M. on the following Saturday. Calculating that Friday was of 24¾ hours, the mean speed on that day was 20·3 knots per hour—a splendid sea speed. If her first trip to New York were placed alongside the first Atlantic run of the City of Paris, which might be perhaps a fairer comparison to the latter steamer, then the difference would be in her favor by nearly a whole day, and if the City of Paris improves as has the Etruria, what are the possibilities? This style of reasoning we do not care to follow, and we will therefore leave it to the imaginative reader.

The homeward journey, as we have already indicated, is a much more pronounced success. The time taken from Sandy Hook to Queenstown was 6 days 5 hours 55 minutes. She left Sandy Hook at 9:10 A. M. on the 17th ult. and arrived at Queenstown at 7:40 P. M. on the 23d ult. After she left Sandy Hook the engines were slowed for 24 hours. The weather experienced was strong easterly winds with high head sea and some fog. The best day's run was 470 knots, a very good record for less than 24 hours. It is very remarkable that the Umbria crossed the Atlantic three days in front of the Inman liner, and the comparison between the logs is very interesting. Here they are:

CITY OF PARIS.	Miles.	UMBRIA.	Miles.
April 17 (part day)	442	April 14 (part day)	344
" 18	432	" 15	446
" 19	440	" 16	439
" 20	461	" 17	454
" 21	460	" 18	451
" 22	470	" 19	447
" 23 (part day)	150	" 20 (part day)	301
Voyage, 6 days 5 hrs. 55 min.		Voyage, 6 days 3 hrs. 50 min.	

The Umbria had fresh breezes throughout. The Etruria three weeks ago took 6 days 9 hours to cross, her log giving the longest day's run as 440 knots. The Umbria, in November last, made the record 6 days 2 hours 32 minutes, having left New York at 2:29 P. M. on Monday, November 12, and arrived at Queenstown 10:1 P. M. on the Sunday following. She thus beat by 2 hours 18 minutes the record of the Etruria in July last. The logs of these two voyages are given, with that of the City of Paris, in the following table:

UMBRIA.	Miles.	ETRURIA.	Miles.	CITY OF PARIS.	Miles.
Nov. 13 at noon	380	July, 1st day out	384	April 17	442
" 14 "	454	" 2d "	460	" 18	432
" 15 "	442	" 3d "	452	" 19	440
" 16 "	454	" 4th "	454	" 20	461
" 17 "	464	" 5th "	445	" 21	460
" 18 (34 hrs.)	632	" 6th "	456	" 22	470
		Part 7th day	280	" 23 (part)	150
Time, 6 days 2 hrs. 32 min.		6 days 4 hrs. 15 min.		6 days 5 hrs. 55 min.	

It will, therefore, be seen that the City of Paris has but 3 hours 23 minutes to take off her time, so that the chances of her breaking the record can be easily appreciated.

[To the above we have now to add the third and last trip of the City of Paris, from Queenstown to New York, when the ship accomplished the fastest voyage ever made, namely, 5 days 23 hours 7 minutes. She left Queenstown May 2 and reached New York May 8. Her daily distances are reported to be as follows:

	Miles.		Miles.
May 3	445	May 6	505
May 4	492	May 7	511
May 5	504	May 8	398

The average speed was about 23½ knots. The distance from Queenstown to Sandy Hook is 2,855 miles.]

California Fruit Statistics.

The value of the California fruit crop this year is estimated at $24,000,000, of which fresh and dried fruits amount to $6,500,000 each, and raisins and citrus fruits $3,500,000 each. The wheat crop is estimated at 70,000,000 bushels, worth $52,000,000; barley, $5,500,000; vegetables, $3,750,000; wool, $6,000,000; dairy products, $7,500,000; wine, $4,000,000. The total of all products, not including manufactures, amounts to $185,000,000.

Electric Door Openers for Use in Asylums.

BY M. J. WHITE, M.D., SUPERINTENDENT OF THE MILWAUKEE HOSPITAL FOR INSANE, WAUWATOSA, WIS.

The idea of providing some means of instantaneous release for inmates of asylums, in the event of fire or panic, has occupied my attention and study for some time past. The necessity of furnishing some certain method of release will be quite apparent, tending as it will to relieve apprehensions existing in the minds of many patients—notably new admissions of a mild type of disease, and convalescent patients, both of which classes are quick to appreciate their surroundings, and for whom the terrors of fire are very potent. Reflecting, as they do, upon the fact that they are locked on one side and barred upon the other, the disquietude occasioned by their situation must certainly be prejudicial to the chances of a speedy recovery, at all events it militates against the equanimity which might obtain were their fears on that score relieved.

The utility of this system will be readily appreciated by all familiar with the management of institutions of this character, more particularly by those connected with the smaller asylums, where the number of attendants is apt to be proportionately small, as it effectually removes the risk of attendants becoming panic stricken, and in consequence forsaking their charges. I was most forcibly impressed on this subject of speedy release in case of fire by a conversation with a female patient in this asylum—a woman of superior intelligence. In the course of conversation, she said to me, "Doctor, what is to become of me if a fire should break out on this ward? I am virtually caged in this room." I replied, "You would immediately be released by the attendants in charge of the ward." She returned, "I wish I could persuade myself that such would be the case, but unfortunately I am tortured by the doubt that the 'girls' would lose their presence of mind and, thinking only of their own safety, would leave us to our fate." I allayed her fears as best I could, but the impression remained with me until I decided to leave open the doors on that ward—a convalescent ward—which I did, with a few exceptions.

I then considered that this way out of the difficulty was not solved in the case of the great majority of the inmates, and accordingly I began to reflect upon the subject of securing some means of controlling all the doors instantaneously and simultaneously, and which, moreover, would place the safety of the patients in most trustworthy hands. I entered into correspondence with superintendents of various asylums throughout the country to ascertain if any system was in operation, mechanical or otherwise, whereby a number of doors could be opened simultaneously. I received negative replies in every case. The system in use in penal institutions was the only one known, and that was to be deprecated on account of the association suggested. The idea of using compressed air was then entertained, and was abandoned for that of electricity.

I consulted with an electrician, and together we ascertained that a door opener operated by means of electricity was in use in large apartment houses, having superseded the mechanical device formerly employed, but that its operation was confined to one door. It was argued that if a single door could be controlled by this means, an indefinite number could be operated similarly, provided sufficient battery power were used. The lock referred to was sent for, put in place and connected, and it operated satisfactorily for a time, suddenly it failed, and upon investigation it was found that the lock not being incased, small particles of dust and plaster had dropped into it and crippled its working mechanism.

Moreover, it was determined that the lock was not built with an idea of resisting sufficiently force which would likely be exerted upon it, also that the spring push, which was secured higher up on the door, was too much of a toy affair and could be tampered with by patients so inclined. Another lock was procured, which was stronger in every way, in construction, and possessed the advantage of embodying the lock and spring push in one piece, also being so constructed as to render it incapable of being toyed with or its mechanism to be interfered with by mischievous patients. The same objection presented, however, viz., it not being incased. This we remedied by means of plates on all sides.

I addressed the board of trustees of this asylum on the subject of providing a means of certain and speedy egress in case of fire, setting forth the dangers of relying solely upon the presence of mind of the attendants in such emergencies, dwelling on the defective condition of the mechanical locks which have been in constant use since the establishment of the institution, moreover, explaining minutely the perilous situation of the patients, which could not be fully appreciated by those dwelling in houses where window grating was unknown. I also endeavored to impress sufficiently the fact that the number of attendants was of necessity proportionately small, and the time consumed in unlocking doors separately, provided the attendants preserved their composure, would be necessarily considerable and possibly hazardous.

The gentlemen of the board, appreciating the force of the arguments adduced in favor of the system, and being strongly alive to the necessity of neglecting no practicable means to provide protection to the inmates, granted me the power to equip ten doors and operate them for a period sufficiently long to demonstrate beyond a doubt the feasibility of the scheme. Ten doors were accordingly fitted out in this manner, and they have been in successful operation for a considerable period, and give undoubted promise of fulfilling the work required of them.

I will describe briefly the device used and the method of its application for use in asylums. The lock is set into the door jamb, and operates in connection with the bolt of the mechanical lock, which is of course situated in the door. In this manner, the bolt of the mechanical lock is slid behind the bolt of the electrical apparatus and held there securely by it until the current is turned on, when the electrical bolt recedes into the lock and releases the mechanical bolt. At the same instant a mechanical device, situate in the lock, in the form of a powerful spring push, and which, by the way, is up to the highest state of tension when the door is locked, is released, and acting upon a small brass plate fastened to the door, serves to throw it a distance of three feet. The door is thrown open with its bolt shot and immovable and cannot be closed again except by means of the key, as the electric bolt is immovable save when influenced by the current. This forms an advantage in preventing viciously inclined patients from securing themselves in their rooms or inveigling attendants therein and imprisoning them, as might happen in case a spring latch were used, as was suggested to me at one time.

The device has the appearance of an ordinary lock, and nothing in connection with the system is objectionable as tending to suggest disagreeable associations, as the wires are all concealed under the mouldings of the door frames and carried through the floor to the ceiling below in the basement, and along it to a locked cabinet containing the cells. At present the ten doors are operated by means of eight cells, the ordinary Bell battery with sal ammoniac solution being used. A test of the apparatus is practically made every morning, as the patients are released in this way, and in case of any imperfect working the defect can be immediately traced and corrected, so as to insure its efficiency in any event. The push buttons are located in the attendants' rooms and are operated at that point, but in order to make assurance doubly sure the wires are to be carried to the superintendent's office and are to be controlled from that point also. It is intended also to have a separate button to operate the exit and fire escape doors, which will be used solely in case of emergency. This arrangement will provide a perfectly free exit from the building as well as from the sleeping rooms.

I have recently introduced a fire drill among the patients, so that at a given signal they hasten to the hall and form in a double column, when they are counted by the attendants and marched to the fire escape. It may seem an incredible statement, but the great majority of our patients respond promptly to this drill. I would say that in carrying this out I have relied greatly on the force of habit, which obtains as prominently among the insane as among the sane, and is quite effective in this instance. I am digressing, but I merely wished to call attention to the value of a drill of this kind in connection with the means of release provided by the electric system of door openers and the advantages resulting from their combined operation.

The subject of the safety of inmates of institutions of this kind is one that is deserving of serious reflection on the part of all interested in the care and treatment of this unfortunate class, and the apprehension of the patient for his or her release in case of fire or panic is certainly worthy of our consideration. If any means can be devised which will tend to promote a feeling of security in minds diseased and morbidly apprehensive, I am of the opinion that nothing of practical value in this direction ought to be disregarded or overlooked.—*American Journal of Insanity.*

Another Chance for Inventors.

According to the *Virginia City* (Nev.) *Enterprise*, the fortune that awaits the inventor of a successful dry-placer machine, or any method by which the gold in the loose dirt on the hills and mountains of Nevada can be separated, will make the present wealthy men of the world have, by comparison, dismal anticipations of the poorhouse. The experiment has often been tried, and as often the result has been only partially successful, often sufficiently encouraging to induce continued effort, but never so far has a profitable working test been made. Frequent failue, however, does not discourage those who have a conception of the possibilities, and detail after detail of discovery and improvement will be made until dry working is achieved.

Owing to the specific gravity of gold, which enables us to collect it by the use of water, wind will probably be the chief agent of separation. The numerous contrivances for that purpose now in existence depend more or less upon the principle by which grain is separated from chaff, and the experimenters have usually directed their attention to modifications of the form and structure of the familiar winnowing machine.

The several methods of utilizing the air have at times been combined with amalgamating plates and with a moderate use of water, which is made to do continuous service. The failure in the sense of profitable working has usually been due to the relatively small quantity of metal saved; that is, the returns have not justified the outlay. There is no question as to the feasibility of making the weight of particles of gold operate in collecting themselves in a distinct mass. It is and always has been only the ratio between value received and value expended that must be overcome by the successful dry separator. Heretofore the wind has been supplied by artificial means, and its application has necessarily been limited. Some time the natural motion of the air will be applied on a large scale, and in such a manner that by a repeated fanning the dry earth may be blown away from the heavier metal. Great air concentrators will be devised that can be operated at an expense merely nominal, and the problem will be practically solved. When this is accomplished, the *Enterprise* adds, the wind, which, like the poor, we have always with us, will blow wealth and prosperity for Nevada.

PHOTOGRAPHIC NOTES.

A New Developer has been very successful in my hands. This new developer, which combines the delicacy which may be obtained by the use of pyro with a beautiful transparent steel gray tone, gives most uniform negatives of excellent printing qualities. The formula which I used is the following:

No. 1.—	Water	1,000 c. c.
	Sulphite of soda	250 grammes.
No. 2.—	Water	1,000 c. c.
	Carbonate of soda	250 grammes.
No. 3.—	Water	1,000 c. c.
	Carbonate of potash	250 grammes.

Now are mixed in a bottle:

No. 4.—	Sulphite solution 1	200 c. c.
	Pyrogallic acid	10 grammes.
	Hydrochlorate of hydroxylamine	2 "

And in another bottle:

No. 5.—	Soda solution 2	100 c. c.
	Potash solution 3	100 "

To develop a plate of 13 by 18 centimeters I mix:

Water	100 c. c.
Pyro solution 4	10 "
Solution 5	20 to 60 drops.

If I have to develop instantaneous pictures, I add at the very beginning 40 drops of solution 5 to the bath, but in the case of time exposures I begin with 20 drops, and, if the picture comes out slowly, I gradually add 5 drops at a time, as often as required with instantaneous exposures. This developer gives plenty of detail, and at the same time soft and brilliant negatives, if the alkalic solution, No. 5, is correctly employed, and neither too much nor too little of it is used.—*H. E. Gunther, in Photo. News.*

A Brilliant Actinic Artificial Light.—A writer in the *Chemiker Zeitung* has recently given the following formula for a penetrating light, which, it is stated, is visible in clear air for a distance of a hundred kilometers, or about 60 miles: Magnesium powder 20 parts, barium nitrate 30 parts, flowers of sulphur 4 parts, beef tallow 7 parts. The tallow is added in a melted state, and the mixture is sifted. This mass, filled in strong zinc cases ten centimeters high and seven in diameter, burns for twenty seconds with a light of 20,000 candle power. Making a rough estimate, this might weigh about a pound, and as it would be one-third magnesium, its cost is quickly seen. Of course such an immensely powerful light would be needlessly great for portraiture.—*British Journal of Photography.*

Depth Daylight will Penetrate Water.—In the month of March sunlight affects a sensitive dry plate sunk to a depth of 400 meters in the Mediterranean Sea. In September the distance is less by 20 meters.

Developer for Collodion Emulsion Plates.—

Hydroquinone	165	grains.
Bromide of potassium	23	"
Citric acid	40	"
Sulphite of soda (crystals)	1½	"
Water	20	oz.

Alkaline Solution.

Carbonate of soda	2 oz.
Carbonate of potash	2 "
Water	20 "

When the exposure is correct, use equal parts of each for the developer. If over-exposure is suspected, use half the quantity of the alkaline solution.—*Fred. W. Muncey, in the British Journal of Photography.*

A HISTORY of sugar was written in 1799 by Dr. Mosely. It states that sugar when first introduced into every country was used only medicinally. Pliny, the naturalist, leaves no room for doubt on this point. Even in Arabia, in the time of Avicenna (A.D. 980-1028), though sugar was an article of commerce from the East, there is no record of its being used for dietetic or culinary purposes for several centuries afterward. It was chiefly used to make nauseating medicines pleasant to take.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

RAIL JOINT.—Edwin M. Cooke, Brooklyn, N. Y. According to this invention, a jacket is formed to receive the meeting ends of the rails, and wedges are driven between the jacket and the base of the rails, goffers or corrugated portions forming the walls of the wedge recesses, while side plates extend up and bear snugly under the base of the rail. Another patent has also been granted to the same inventor for a rail joint of different construction, in which ways or recesses are provided between the upper side of the base of the rail and the jacket, the wedges fitting these recesses being formed of sections having each a straight and an inclined face, one section being inserted in the way and the other section driven upon the first one.

SWITCH STAND SIGNAL. — Michael B. Hurly, Quebec, Canada. A lantern is secured on a rotating sleeve and made to revolve on a stationary lamp and hood, so that corresponding colored lights will only be seen through in the desired direction up and down the track, the device being intended especially for use with three-way switches, or those by which trains may be directed from a main line to tracks on opposite sides.

SWITCH STAND. — Frank C. Baker, Blue Island, Ill. This invention covers a device in which the lever is thrown parallel with the rails of the track, instead of at a right angle thereto, the improvement being especially designed for use in crowded railroad yards.

AUTOMATIC SWITCH. — Adelbert G. Lawrence, Motley, Minn. This device consists of two revolving shafts placed beneath and at right angles to the main track and side track, and connected by means of levers, links, and pitmen to a throw bar underneath, and attached to the movable track, the switch being operated automatically by the flange of the car wheel.

CABLE GRIP. — Charles S. Chapman, Kansas City, Mo. This is a double socket grip designed for use on roads having duplicate cables, or on single-track roads having passing switches and cables running in both directions in the same tunnel, the main object of the invention being to so construct the grip that the parts subject to the most wear may be readily removed and replaced.

Agricultural.

PLOW. — William W. Leak, Montgomery, Ala. This invention covers a novel construction of the plow point, designed to obviate the necessity of resharpening by providing plates thin enough to form an edge for the plow, and adapted to be adjusted down on the body of the plow point as the plate is worn away.

CULTIVATOR.—Theodore Meyer, Amity, Iowa. This device is intended as an attachment which may be applied to an ordinary two-wheeled straddle row cultivator, providing a harrow wherein a single group or a series of groups of rotary teeth may be readily adjusted vertically and also laterally to avoid contact with the plants not in line, while the teeth may be rotated while being so adjusted.

Mechanical.

PULLEY SUPPORT.—Adelbert G. Lawrence, Motley, Minn. This device relates to pulleys for shifting belts, a yoke being turned to fit on the ends of the boxes, and capable of being adjusted to any angle, supporting at its center an arm terminating in a box between the pulleys, which supports the ends of the shafts, on which are journaled working and idle pulleys, doing away with wear and jumping of the idle pulley in machinery run at high speed.

BRICK LAYER'S PLUMB LEVEL. — James Smith, Centerville, Md. It consists of a frame to which is applied angle castings or guides, the frame also having graduated plates, while at each side of the frame is a plumb level or bob, and also a spirit level, making a convenient and accurate instrument, which can be expeditiously handled.

BUTTON MACHINE. — Anton Scholz, Brooklyn, N. Y. In this machine a yielding plate is employed having a sharp edge surrounding one of the dies and abutting against the other when the dies are pressed together, the machine being specially adapted for pressing glass or jet buttons into perfect shape, obviating additional trimming, and saving material.

COTTON SEED CRUSHER. — John J. Woodward and Peyton B. Bibb, Montgomery, Ala. Crushing rolls are arranged below the hopper, with a clearing distributer immediately above the meeting faces of the rolls, and a cut-off operating between the distributer and the discharge opening of the hopper, whereby if the rolls become clogged the supply may be cut off, the clearing distributer meanwhile operating to clear the rolls.

COFFEE CLEANER.—Augusto Gallardo, San José, Costa Rica. This is a machine for peeling, polishing, and cleaning coffee, the coffee being passed through cones in such way that the pressure of the mass will contribute to the rubbing off of the several coatings and the polishing of the grains, whatever may be their varying sizes.

Miscellaneous.

VEHICLE SPRING. — Albert E. Cook, Knowlton, Quebec, Canada. The spring has its lower leaf formed in two parts with their inner ends connected by a spring, in combination with a rocker-shaped bearing, whereby in the working of the spring its slack will be automatically regulated and an extended bearing for the spring is provided.

SHOE OR SLIPPER. — James Hanan, Jr., New York City. In this shoe or slipper the counter is bare upon its inner surface and split at its lower edge to form a narrow inner flap and a narrow lower flap secured to the heel of the shoe, whereby the shoe is made firmer at less expense, and there is no need of a lining at this point, where the lining most commonly wears through.

IRONING BOARD.—Albert T. Scanland, Dunn Loring, Va. This improved form of board has devices for clamping and supporting the board proper in position on top of a table, be clamped to one end of and extended from a table, or be supported upon and between two chairs.

POULTRY CARRIER.—George M. Beerbower, Cherry Vale, Kansas. There are eyes or staples in the coop or carrier, and a wire, cord, or rod, for securing the legs of the fowls, without injuring their joints, while the carrier is provided with facilities whereby the fowls may be conveniently provided with food and water while in store or transit.

SELF-WAITING TABLE.—Andrew Dahlstrom, Ashton, Mich. Combined with a main table is a supplemental or revolving table, and a suitable spring-operating gearing disposed within the main table, arranged to operate the revolving table, the table being easy to operate, and when in operative condition presenting a neat and ornamental appearance.

CHIMNEY.—Joseph A. Hodel, Cumberland, Md. This invention is an improvement on a former patented invention of the same inventor, and provides a novel construction and combination of parts whereby the chimney may be simplified, rendered easy of connection with the chimney wall, firm in position, and efficient in use.

TRUSS. — Alexander Dallas, Bayonne, N. J. This is a truss for retaining and curing abdominal ruptures, and is made to allow for connection with battery wires for establishing an electric current to the parts subjected to pressure by the pads, to prevent atrophy of the parts.

SUPPOSITORY FORMER. — Wayne J. Hall, Alexandria, Dakota Ter. This is a machine of simple construction wherein suppositories may be expeditiously formed without the aid of heat, and wherein suppositories of different sizes may be shaped.

BOTTLE STAND.—Charles K. Hall, New Orleans, La. This is a stand provided with a support for bottles and a retaining plate, and the stand also has a rim to prevent removal of the bottles from the stand except through a door in the rim, which door may be kept locked, so that only the person holding the key can remove the bottles from the stand.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(795) F. M. asks: 1. Is the simple electric motor described in your SUPPLEMENT suitable for running a propeller in a 12 or 13 foot canoe? A. It would answer. 2. What size propeller should be used for such a boat? A. Use a two-bladed eight inch screw, ten inches pitch. 3. Are four one-gallon cells of Fuller battery sufficient to run the motor, and about what power would be developed? A. They would give about 1-10 horse power. 4. How long will one solution last, that is, how long can the propeller be run by one charge without stopping? A. It depends on the work. One charge might last six hours. 5. How should the battery be connected—in series or parallel? What is the difference in effect between the two ways? A. In series. Even then the voltage would be rather low. Series arrangement increases voltage, and diminishes amperage, and vice versa.

(796) D. S. M. writes: 1. For information in regard to the process used in air brazing or soldering light sheet brass for making tubing. A. File the parts to be joined to an accurate fit, bring them together, and secure with iron wire. Place a mixture of pulverized borax and fusible brass (spelter) in small fragments along the seam and heat in a forge or with a blow pipe. The fusible brass will melt and run into the joint and secure it. Allow it to cool before removing the wire. Also see article in SCIENTIFIC AMERICAN of May 4. 2. Also the amount of sulphuric acid used to the gallon for making water gas. The materials used are old scraps of iron or zinc, sulphuric acid, and water. A. One hundred pounds of sulphuric acid will give about two pounds of hydrogen gas, occupying a volume, under ordinary conditions, of 652,396 cubic inches or 377 cubic feet. For a description of the processes of making hydrogen gas on the large scale, we refer you to our SUPPLEMENT, Nos. 656 and 657, in which various processes are described.

(797) H. W. asks: 1. Weight of one cubic inch of pure platinum. A. About 5300 grains, varying according to the processes it has gone through, rolling, wire drawing, etc. 2. Value of same? A. $120.

(798) F. S. M. asks: I have just completed a simple electric motor according to the plans published by you in SUPPLEMENT, No. 641, only that I reduced the plans one-third, which I figured would give me a little less than one-half the power. I wound both the field magnet and armature with No. 20 single cotton covered wire and made the armature core out of No. 20 iron wire. It runs finely with a battery of four cells with zincs and carbons 5 by 6, but does not give much power. Did I use the right size of wire in winding? I made it carefully to scale and the parts fitted together all right. The battery cells I made out of mill board according to the instructions in last week's SUPPLEMENT, and had excellent success. In addition to a thorough soaking in hot paraffine, I allowed a coating ⅛ in. thick to cool on the bottom inside and then brushed the hot wax all over the inside. They hold two quarts of fluid and are 6 by 7 by 3½ in. in size. The series consists of four cells of the size. How large a candle power lamp would it light? The zincs and carbons are as stated, 5 by 6 inches. A. We think, if you were to connect your field magnets and your armature in parallel, the motor would work better. It will also be well to use two additional battery cells. Such a battery as you now have would light a five-candle power lamp.

(799) J. L. S. asks what thin liquid wood preservative to use on exposed pine trusses that have become slightly checked. Oil paint is almost too thick to flow into the openings. Shall protect them by covering after treatment. A. The best and cheapest preservative for such work is a coat of thin coal tar (thinned with benzine), if there is no objection from its odor. As you say the truss is to be covered, the appearance should not be objectionable. If a water solution is required, we recommend a solution of 20 pounds sulphate of iron to 100 pounds water as the cheapest, and if it can be thoroughly applied by soakage, it makes a very durable preservative. Or you may saturate with corrosive sublimate solution, one pound of chloride of mercury to four gallons of water, although this is very poisonous and dangerous to persons making the application.

(800) C. H. B.—The "median power" of Oliver Evans is the center of percussion of revolving bodies, or "center of gyration" of the later books. Its distance from the center of a true disk is called the radius of gyration. In a millstone which is supposed to be nearly a perfect disk, the distance of the center of gyration from the center of motion is ·7071 of the radius from the center or radius ×0·7071. See Haswell's Engineers' Pocketbook, which we can mail for $4. The center of gravity in a trapezium and trapezoid are also illustrated with rules and formulas in Haswell.

(801) S. C.—For clock and musical bells no other metals than copper and tin should be used. Copper 1 pound, tin 5¾ ounces is as hard a composition as can be used to advantage. It is used for clock bells and gongs. In casting the gongs should be gated at several points along the edge from a side runner. Stand the flask on end as usual with brass founders for pouring, partially dry the gong prints by holding a red hot iron over it for a few minutes, for thin gongs. If they are found to crack by leaving in the mould, remove from the mould as soon as poured and anneal in hot ashes. For other information asked see "Gas Engine," by D. Clerk, for $2.50, which we can send by mail.

(802) J. R. H. writes: 1. How is oxygen and hydrogen gas made. Also is it more compressible than air? A. Oxygen is made by heating chlorate of potash mixed with binoxide of manganese in a retort. The gas comes off quickly below a red heat. Hydrogen is made by dissolving zinc or iron scrap in suphuric or hydrochloric acid. They differ but slightly in compressibility from air. 2. If you have a cylinder one-half full of water and the rest full of air, pressure 100 pounds per square inch, in the top of the cylinder a hole less than an inch in diameter, in that hole put a funnel, insert the small end of it in the hole in top of cylinder, if that funnel is full of water, will it run into the cylinder? A. No. Air would bubble out through it until the pressure was reduced, when it would run in. Some water, however, might work its way in along the sides of the funnel tube while the air was escaping. 3. If in that cylinder you make two openings, one into the air and one into the water, each 1 square inch, the opening into the air will have a pressure of 100 pounds, what pressure will the one leading into the water have? A. In the water opening there will be a little more than 100 pounds outward pressure, owing to the weight of the liquid column above it. 4. Is it possible to temper copper to the hardness of steel? If so, how is it done? A. No way of doing this is known.

(803) E. A. D. writes: 1. I have several fonts of job type and a first class dental vulcanizer. Can I use the latter for making rubber stamps, and, if so, how? Please give full directions. A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 83 and 569. 2. Where can I get the rubber for the above purpose? A. Apply to any rubber belting, packing, or supply house. Consult our advertising columns. 3. I have noticed that, in some of the so-called induction machines now on the market, the coils are not induction coils at all, but simple coils wound with very fine wire. Does this coil in any way increase the intensity of the current passing through it? A. Such a coil gives an intensified extra current on making or breaking the connection. 4. A receipt for a nickel solution for plating. A. Consult

the files of this paper. In our SUPPLEMENT, Nos. 192 and 425 and in others also, processes are given. 5. In plating articles of iron, tin, etc., with copper, the copper scales off and will not adhere firmly. How can I remedy this? A. You should use an alkaline copper bath, until the metal is covered, then you can finish in the ordinary bath. A cyanide bath will answer. You should have some good treatise on the subject, such as is contained in our SUPPLEMENT, No. 310. 6. In what number of the SCIENTIFIC AMERICAN can I find the article on the isolation of fluorine? A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 577, contains a full descriptive and illustrated article. 7. What is the true height of the Eiffel tower, 984 or 1,178 feet? A. 300 meters or 984¼ feet. 8. In what way does the Geissler differ from the Sprengel air pump? A. See our SUPPLEMENT, Nos. 629, 630, and 631, for full description and diagrams of all leading mercurial air pumps. 9. How can I purify mercury for use in a barometer? A. Distill it from an iron retort. 10. Will I be permitted by the Bell Telephone Company to make and use the telephone described in SUPPLEMENT, No. 142? A. You will be open to suit for infringement. They can only stop you by procuring an injunction in a federal court. 11. From what is beer yeast obtained? A. From fermenting malt infusion. 12. What work on electricity can you recommend? A. There are a very large number of excellent works devoted to the different branches of the subject, any of which we can supply. We suggest Ayrton's Practical Electricity, $2.50; Electricity in the Service of Man, by Wormell, $6; Larden's Electricity, $1.75.

(804) J. P. wants to know how to oxidize brass by a dip so as to give it a cherry color. A. For brass dip changing the color through brown to a full red. Solution of 1 pint water, 16 drachms nitrate of iron, 16 drachms hyposulphite of soda. Another solution is 1 pint water, 16 drachms hyposulphite of soda, 1 drachm nitric acid.

(805) C. A. K. S. writes: Can you furnish me with the receipt for making Worcestershire sauce? A. Mix together 1½ gallons white wine vinegar, 1 gallon walnut catsup, 1 gallon mushroom catsup, ½ gallon of Madeira wine, ½ gallon Canton soy, 2½ pounds moist sugar, 19 ounces salt, 3 ounces powdered capsicum, 1½ ounces each of pimento and coriander, 1½ ounces chutney, ¾ ounce each of cloves, mace, and cinnamon, and 6½ drachms asafetida dissolved in 1 pint brandy 20 above proof. Boil 2 pounds hog's liver for 12 hours in 1 gallon of water, adding water as required to keep up the quantity, then mix the boiled liver thoroughly with the water, strain it through a coarse sieve. Add this to the sauce.

(806) R. & V. H. (Neb.) ask: Can there not be some use made of the hundreds and thousands of plow shares and mould boards of plows that now lie around our blacksmith shops in the great West? A new lay or share costs from $3 to $4, and a mould board from $6 to $8. It seems that the steel in the old and partly worn ones ought to bring something. A. Iron and steel in any form has a market value in the Eastern and Middle States. First quality cast iron scrap is worth $12 per ton. Second quality, such as chilled plow points, $8 to $10 per ton. Cast steel scrap, first quality, $18 per ton. Second quality, such as steel mould boards, $16 to $17 per ton. You should be able to find a ready market for steel scrap in Chicago.

(807) A. H. T. asks: 1. What is the relative manufacturing cost of pressed and blown glassware? A. Pressed glass is the cheapest for plain goods. A comparison cannot be fairly made in general terms for pressing is a necessity in cheap figured goods, which cannot be made by blowing alone. 2. Can thin ware like thin tumblers be made by the former process? A. The thin goods so much in vogue now cannot be pressed and retain the fine, clear qualities of the blown goods. 3. Can pressed ware be accurately enough made to form close joints in articles made in sections, or is grinding necessary? A. There is a possibility of making jointed articles that are to be closed with rubber, but a tight glass to glass joint without packing cannot be thus made.

(808) P. B. M. asks: What velocity has air driven out of a 4 inch by 4 inch square pipe, two feet from end of it? Running at velocity of 130 feet per second from out of the pipe. A. There are no data for the decreasing velocity of air projecting from a nozzle. The vortex produced by contact with the outside air of the same specific gravity commences at the nozzle, so that at two feet distance the central portion of the blast would retain most of the initial velocity, while the outer portion would be greatly retarded by admixture with and putting into motion the surrounding air. The velocity is no doubt inversely in proportion to the distance that the blast is felt, so that if the blast produces a perceptible movement at 50 feet distance, then 127 feet would be the approximate velocity at 2 feet from the nozzle for the central portion.

(809) A. H. M. asks for a recipe for staining pine, ebony or black, a black that acids will not discolor. A. Boil 40 parts gall nuts, 4 parts rasped logwood, 5 parts sulphate of iron and 5 parts verdigris with water. Strain through linen and apply the warm fluid to the wood, and then give it three coats of a warm solution of 10 parts of iron filings in 75 parts of vinegar. To prevent discoloration of the stained wood by acids, polish the surface with paraffine.

(810) G. E. C. communicates the following: This formula has given perfect satisfaction as a flour paste for all purposes. Mix 1 pound rye flour in lukewarm water to which has been added one teaspoonful of pulverized alum; stir until free of lumps. Boil in the regular way or slowly pour on boiling water, stirring all the time until the paste becomes stiff When cold add a full quarter pound of common strained honey, mix well (regular bee honey, no patent mixture). In labeling I always paste my tin (or my work) and apply my label except where I have a narrow label, and pasting the tin would mar the other work, but where the paste is put on tin we find it to hold perfectly.

(811) J. O. B. asks for the best composition of bell metal for tone for musical bells. A. Nothing but copper and tin should be used for such bells. The composition varies for tone from 16 ounces copper and 4 ounces tin to 16 ounces copper and 3½ ounces tin. The first gives the finer tone. See Query No. 801.

(812) T. O. D. asks how long compressed air (300 pounds pressure) would remain in an iron tank provided there was no leakage through valves. A. The air at that pressure will remain for an indefinite time without leakage. The tank should be tested by placing a little ether in the suction of the compressor, when, if there are any leaks, they can be found by the smell, in the same manner as gas fitters find leaks in gas pipes.

(813) H. M. E. asks: What is the principle of the Ericsson caloric engine? A. See description of Ericsson's caloric engine, illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 70.

(814) M. L. Co. — Mica of fine, clear quality and large size is much used in the stove trade and for miners' lanterns. Refuse mica is used for paint body by grinding.

(815) S. I. asks: What is phenol-phthalein, and where could it be obtained, as I wish to procure some for analytical purposes? A. It is an organic compound based on phenol, two hydrogens of the original benzol group being displaced by $2C_6H_4O_2$. It is sold by dealers in chemical supplies.

(816) S. S. writes: A piece of metal composed of gold and silver weighs 22 ounces in air and 20½ ounces in water. What proportion of said metal is gold, and what proportion silver, assuming the specific gravity of gold to be 19·34, and silver 10·50. A. 22−20½ = 1½ = the weight of water displaced by 22 ounces of the alloy. Its specific gravity therefore is $\frac{22}{1\frac{1}{2}}=14{\cdot}66$.

Taking one hundred parts as the basis, and denoting parts of silver by x and of gold by y, we have the following equations:

$$(1)\ x+y=100$$

$$\text{and } 10{\cdot}5x+19{\cdot}34y=100\times14{\cdot}66=1466.$$

Solving these we find

$$x=55{\cdot}23 \text{ parts in } 100$$
$$y=44{\cdot}77 \quad `` \quad `` \quad ``$$

(817) J. A. D. writes: Are there any means by which a man might efface marks that have been tattooed on his hands by means of dye stuff? A. We refer you to our SUPPLEMENT, No. 695, for an article on the above subject.

(818) E. V. writes: 1. Can you tell me a good remedy for pimples? A. Lead a perfectly healthy life and eat moderately of simple food. Bathe the face with a solution of Rochelle salts. 2. A receipt to whiten hands? A. Wear gloves, wash the hands frequently with best quality soap, and occasionally with javelle water.

(819) H. H. asks for a recipe for an effective gargle. A. For a very mild one use salt and water; for a more effective one use about 1 drachm chlorate of potash in 2 ounces of water, or ½ to 1 ounce alum in 1 pint of water sweetened with honey. The chlorate of potash gargle must be used with care, as it is poisonous.

(820) A. E. M.—The sample is magnetic iron ore. We can take charge of the assay. It will cost $5 for determination of iron, determinations of sulphur and phosphorus will cost $5 apiece. We should be glad in any case to have you send four or five pounds by express to our address for our further examination.

(821) W. P. H. asks (1) how to clean carpets on the floor to make them look bright. A. To a pailful of water add three pints of oxgall, wash the carpet with this until a lather is produced, which is washed off with clean water. 2. How to take out varnish spots from cloth? A. Use chloroform or benzene, and as a last resource spirits of turpentine, followed after drying by benzine.

(822) W. H. P. asks for a good carbon or manifolding paper, such as used in operating type writers. A. Melt together 1 part beeswax and 6 parts of lard oil, and mix in lamp black and a little Prussian blue. As regards proportions of coloring matter, use judgment. It should be done in a warm mortar. In place of above coloring matter you may use logwood carmine or any good form of dry pigment.

(823) J. M. F.—Iron pyrites, no value, composed of sulphur and iron.

(824) J. B. C. asks whether a form of wood, flat or other shape, could be coated with a film of copper that could be separated from the wood without injury to either, so that the wood could be used again. A. Yes; dry the wood, immerse in hot paraffine, coat with plumbago, and plate with a battery. See our SUPPLEMENT, Nos. 157, 158, and 159, for batteries, and No. 310 for electro-plating.

(825) A. B. writes: 1. An electro-magnet of certain dimensions, with the wire wound in one piece, will sustain 145 lb. With the same wire cut into seven pieces it sustained 750 lb. Were the seven pieces wound side by side or did each piece form a layer? A. The seven pieces may have been wound side by side or in different layers. This of itself makes no difference. It is probable that the pieces were connected in parallel circuit, so as to enable the wire to take a heavy current. 2. Please describe a commutator. One suitable for a two inch Simmes armature. A. For description of commutator see SUPPLEMENT, No. 600.

(826) Student asks: 1. How are the red, blue, and black characters put on society pins? A. The colors referred to are put on by means of enamel, which is fused upon the surface of the metal. 2. What is the best battery for running an electric motor, and what are the materials used in making it? A. Use a plunging bichromate battery. 3. Is there any way to tell the amount of wire needed on the field magnets and armature of an electric motor, if you know the size of the magnets and wire? A. Consult Hering's "Dynamo-Electric Machinery."

(827) C. E. R. writes: I am interested in plating with gold. Can you inform me or tell me where I can get information as to the right solution to use and the manner of making and using such solution? A. For a brief and reliable treatise on electroplating with gold and other metals we refer you to our SUPPLEMENT, No. 310. We can also supply you with the standard works on the subject, such as Watts' Electro-Deposition of Metals, $3.50.

(828) W. H. L. asks: If lily of the valley flowers (in quantity) are put into Atwood's alcohol, 95 per cent, will the alcohol absorb the perfume? A. To a very limited extent only. The perfume should be extracted by maceration in oil or grease or by simple absorption by grease, and then obtained as an alcoholic extract if desired. We can supply you with books on the subject of perfumes at regular price.

(829) W. J. P. writes: Is there any way to give brick the red color of those burned from clay rich in oxide of iron? Would it probably be too expensive to mix ground uncalcined oxide with the clay? Mixing ordinary black loam with clay affects the color to some extent, but is apt to injure the strength of the brick. Putting salt in the fire near the close of a burning to a limited extent gives a dark red to the brick, but this is apt to take place only where the brick are subject to a great heat. What is the chemical action of this last? A. We doubt if you obtain any practical success by such mixture, owing to the expense and difficulty of securing a homogeneous mixture. As regards the chemistry of the salt process, it may operate as a flux, fusing with the light colored silicious portions into a colorless glass, and not affecting the iron oxide, or it may even volatilize some of the alumina as chloride. It is not easy to state its action without examination or analysis.

(830) H. F. K. — To mount prints on glass, follow the directions given by J. E. Dumont, that is, take four ounces of gelatine and soak half an hour in cold water; then place in glass jar, adding sixteen ounces of water; put the jar in a large dish of warm water and dissolve the gelatine. When dissolved, pour into a shallow tray. Have your prints rolled on a roller, albumen side out; take the print by the corners and pass rapidly through the gelatine, taking great care to avoid air bubbles. Hang up with clips to dry; when dry, squeeze carefully on to the glass. The better the quality of glass, the finer the effect. Also see page 120 of February 21, 1885, issue of the SCIENTIFIC AMERICAN. You can make transparencies on glass with photographic apparatus. See book called "The Amateur Photographer."

(831) A. R. asks (1) how to prepare a lacquer to keep brass tools from tarnish. A. The tools must be cleaned and polished so as to be absolutely free from grease. They are next slightly warmed and varnished with a solution of seed lac or shellac in alcohol. The success of the operation depends on the clearness of the surface. A finger touch before varnishing will affect the finish. 2. How can gold be tested as to its karat, besides the test stone process, and give more minute distinction than this latter? A. An analysis or assay is the only reliable method. Sometimes the specific gravity is determined, and from this the composition is deduced by algebra, but the method is only approximate, and can only be used where the alloy or metal mixed with the gold is known. See next query

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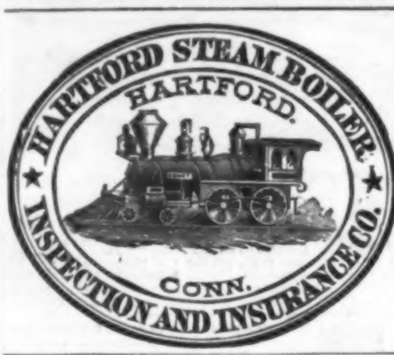

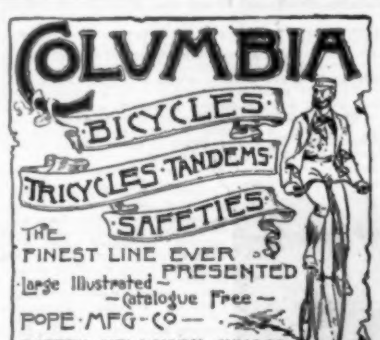

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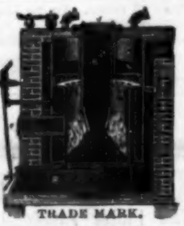

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